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OF

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CONTENTS FOR JANUARY, 1930.

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Technical Editor - - JAMES P. OGILVIE, F.I.C., F.C.S.

For **INDEX TO ADVERTISERS,** see pages l.—liii.

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No. 373. JANUARY, 1930. Vol. XXXII.

Notes and Comments.

The Outlook.

With the dawn of a new year, it is to be hoped that the sugar industry will soon see some reaction from the sustained pessimism of the markets that has ruled during 1929; but for the moment that pessimism seems likely to continue. Locally, Mincing Lane is unsettled by the uncertainty of the alterations, if any, to the sugar duties in Mr. Snowden's next Budget, due some time in April. More widely, the chief hope for an improvement in prices seems to be centred in the question whether the Cuban Single Seller can hold on firmly to its sugar for a sufficient length of time to force a bullish position on the market. And there is the repercussive action of the American tariff revisions which have been hanging fire for months, but may take final shape one of these weeks or months, and with results that may or may not upset the Cuban calculations.

As regards the Budget uncertainties, an attempt was made last month to elicit in Parliament from Mr. SNOWDEN the chances of there being some alteration in the silk and sugar duties next April. The Chancellor declined to depart from the invariable custom of not anticipating the Budget statement, but he did promise that the next Budget would carry some scheme of rebates for holders of duty paid stocks. With this the market had perforce to be content. But whether the view will prove well-founded or not, there is a growing belief that since the Labour Government will not find it convenient to part with the revenue from existing taxes, at any rate during 1930 (while it seems difficult to believe that they will ignore all the recommendations of the West Indies Sugar Commission, which from all accounts are likely to be decisively in favour of continuing assistance to the British sugar colonies and the Dominions), therefore the sugar duties will be continued more or less unimpaired. If there are any modifications it seems less likely that these will take the form of altering the Preference duties with their wider Imperial implications than of modifying or even discarding the preference accorded Home refined as against imported refined. The possibility of the latter must not be lost sight of, as it is purely a domestic measure. Much depends on whether the threat to employment at home by any such change will or will not count for more in the counsels of the Government than the problematical disadvantages, to the consumer, of this country being dependent on practically one big firm for its refining requirements.

As for Cuba, the Single Seller has so far remained firm and (to paraphrase some comments of a well known market authority) if it has the strength to withhold from the markets for some months millions of tons of sugar, without which some at least of the world's buyers cannot do, the ascendancy of sellers over buyers may be broken, and the initiative for the transaction will pass to the buyer, who will necessarily bid the price up. On the other hand, if Cuban resistance is broken, other world producers will be bound to give way too, and sugar may experience further low records.

There have been rumours in the European press of a new Brussels conference to be held in the near future; and anticipation, less or more intelligent, credits it with the probable presence of a Dutch "observer" and with an intention to formulate a combined action against Java sugar. But LICHT discredits these rumours and avers that the only real fact is that the next conference will probably be held at Brussels, but neither the exact date nor the programme has yet been settled.

The Rate of World Increase in Consumption.

Mr. J. HUMBERT, of Magdeburg, in a recent Circular draws attention to some figures of world stocks and consumption increases that have lately appeared in the *Deutsche Zuckerindustrie*. A study of these figures arrives at a 6 per cent. increase in World consumption for the last campaign. F. O. LICHT found for the twelve European countries which he regularly surveys an increase of 4·7 per cent., and Dr. MIKUSCH for the whole of Europe (including Asiatic Turkey) one of 4·03 per cent. or (excluding Russia) one, as it happened, also of 4·7 per cent. General approval seems to have been expressed with MIKUSCH s intimation that the reaction to the restriction of the European consumption during the war is now coming to an end, and it seems advisable to reckon now on pre-war increases of 3 to 4 per cent. (advisably not above 4 per cent.) rather than on any 5 to 7 per cent. increase such as has prevailed during the last six or seven years. This view is strengthened by the fact that LICHT's September/October consumption figures for regularly controlled Europe show a decrease of 3 per cent, while the U.S. consumption also falls below expectations. The German organ found for 1928-29 a world production of 27,457,000 tons and a world consumption of 26,827,000 tons, giving an increase of the visible stocks of 630,000, i.e., to 4,760,000 tons; while for 1929-30, production is estimated at 530,000 tons lower, i.e., at 26,927,000 tons.

A hypothetical increase, remarks HUMBERT, of 3 per cent. in consumption for the whole world (representing about 800,000 tons) would—with the existing low level of prices—probably fall short of general expectations, yet even this would make good last year's 630,000 ton increase of visibles, should the world crops actually turn out to be 530,000 tons less. This latter figure happens to be about the average of the deficiencies calculated respectively by WILLETT & GRAY (328,000) and *Facts about Sugar* (750,000). The difference between them is well known to be chiefly due to divergent opinions concerning the Cuban and British Indian crops. The authority of WILLETT & GRAY is above dispute but their more moderate figure of deficiency is not as yet corroborated by other expert opinions, and they seem to be alone in forecasting a Cuban crop of 4,900,000 tons. In Cuba, we gather, the prevailing estimate is at present around 4½ million tons, with 4,700,000 long tons as a possibility.

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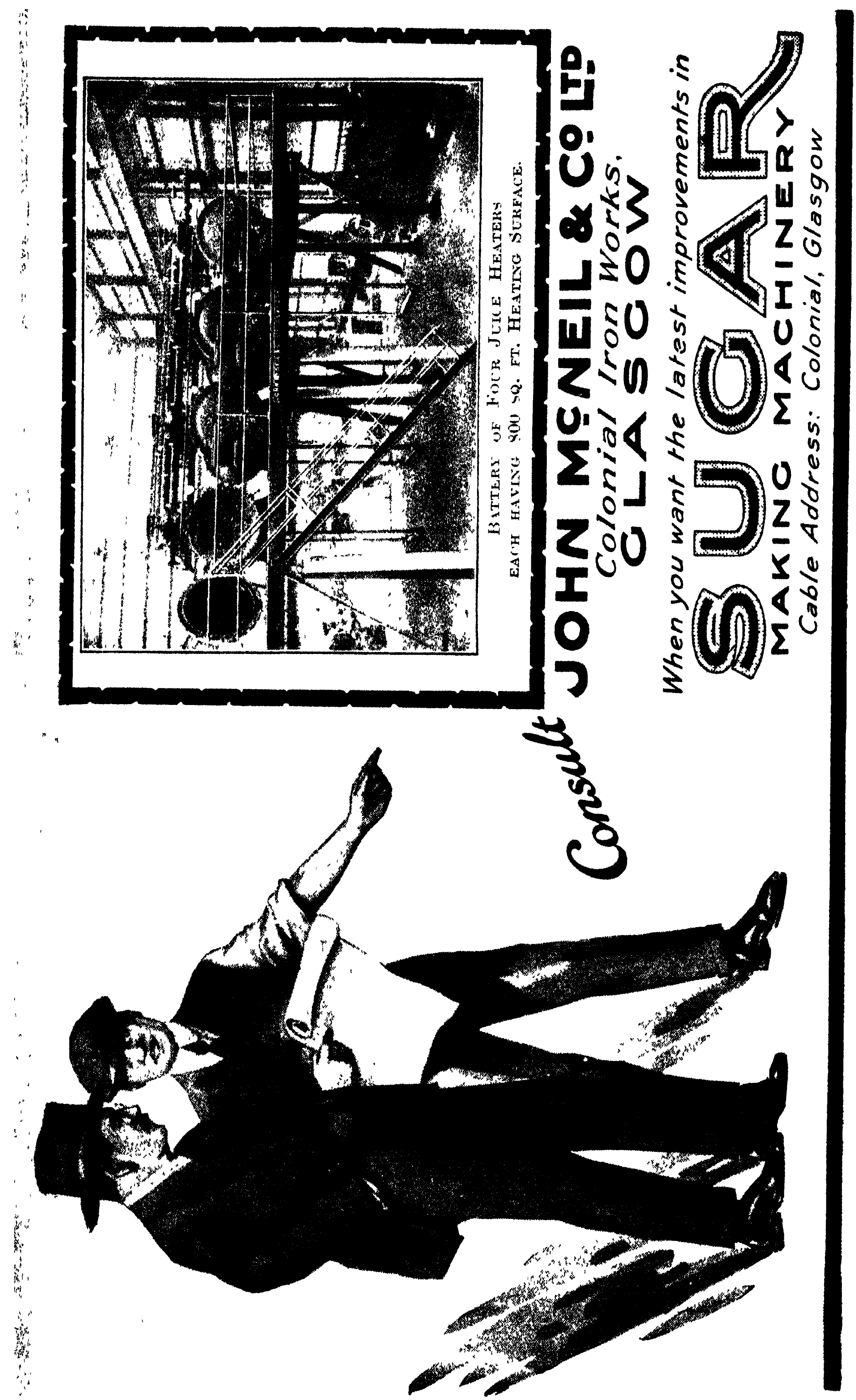
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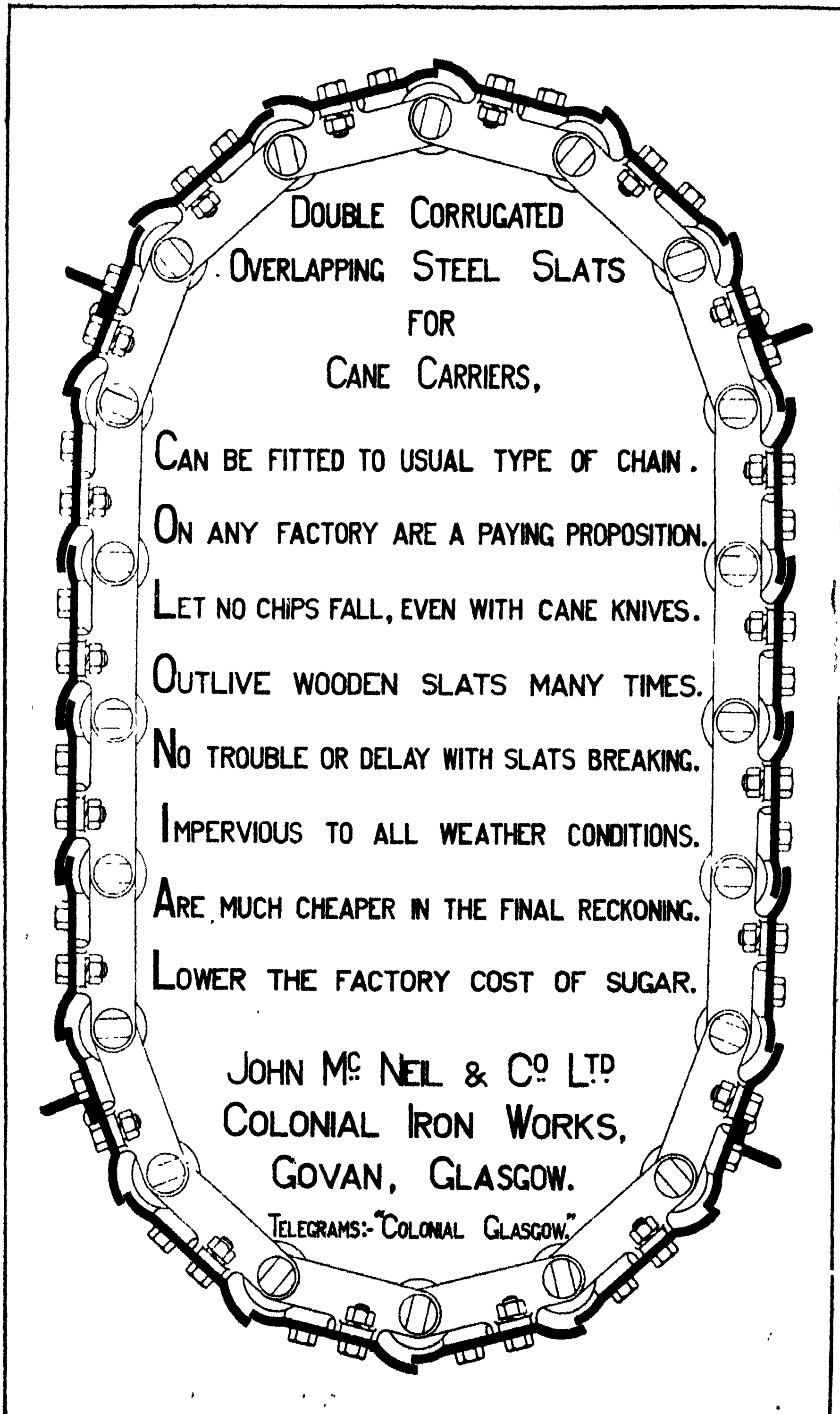
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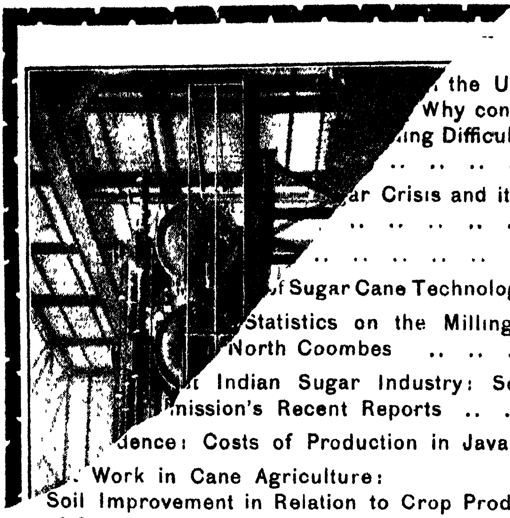

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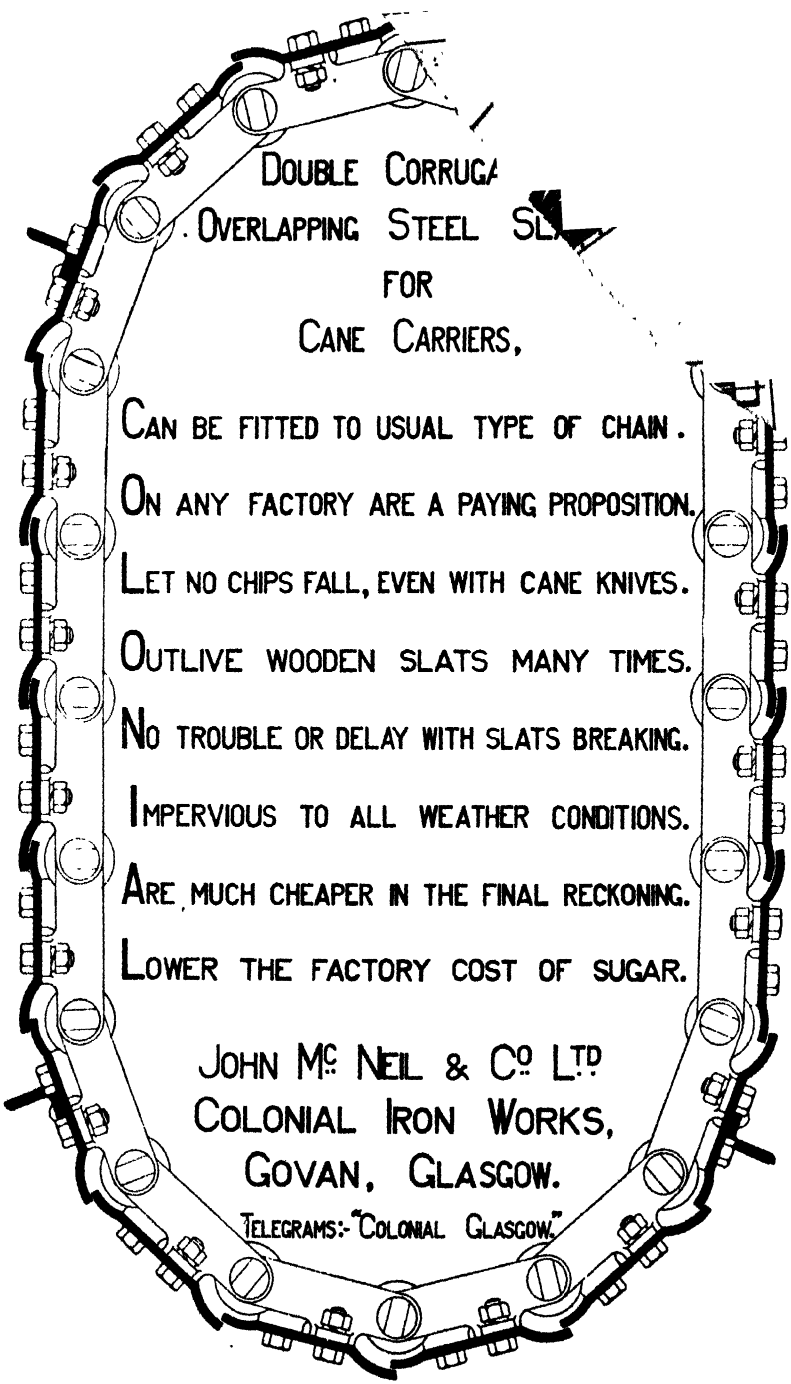
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The British Refining Industry.

The Budget of 1928, as is well known, proved a godsend to the British refining industry, for it has caused the imports of foreign refined practically to cease. As a consequence the home refiners have been able to set their houses in order, keep their refineries steadily at work through the year, and employ a good deal of extra direct or indirect labour. This has been all to the good, and the results are well reflected in the annual accounts and report of Messrs. TATE & LYLE (summarized on another page) which seem to have been satisfactory to workers, shareholders, and even to consumers.

The only query that occurs is prompted by the consideration that the new fiscal monopoly has enabled the leading refiner to buy up one rival refinery after another, till now Messrs. TATE & LYLE virtually control the refining trade in this country. It was natural that they should seize the opportunity to secure control of Scottish refineries which were either closed down or faced with uncertain outlook; but their acquisition of the FAIRRIE refinery at Liverpool (at a price said to be over half a million) was dictated by a desire to prevent a foreign rival doing the same, and so securing a good footing in the British refining trade. As it is, there is now very little sugar produced or refined in this country that is not in the hands of TATE & LYLE. Whether, then, it is good for the sugar trade at large that so complete a monopoly should be in the hands of one firm is a matter that is agitating a good many minds in the trade. It has certainly curtailed very seriously the freedom of trade in the sugar broking business (as witness the cessation of operations of the oldest firm of sugar brokers in Glasgow), and Mincing Lane as a whole has had every cause to resent the changes which the 1928 Budget has forced on them, in particular on the smaller firms. But viewed from the national point of view the chief criterion will centre round the question whether the consumer is likely to suffer from so important an item of food being in the hands of one big producer instead of in those of a number of competing firms. There is no indication as yet that he is threatened, but the situation is one that will not be free from anxiety, and it will doubtless receive the close attention of political and economic critics.

The United Kingdom Beet Crop.

Although somewhat hindered by the excessive rainfall during November the lifting of this season's beet crop in England was carried through with sufficient expedition to keep the factories fully employed. The absence of early winter frosts this year has been an advantage. Reports on this crop have been almost uniformly good as regards condition and sugar content, but the later lifted roots were generally not so clean. The acreage under beet showed the marked increase of 30 per cent. over that of 1928, or a total of 232,000 acres, and was the largest on record. The sugar content has also been high, averaging about 18 per cent., while the yield per acre of washed and topped roots is likely to be about 8 tons or much the same as last year, and the total production of roots will be in the neighbourhood of 1,860,000 tons.

For the coming season farmers have contracted with the factories to grow 315,000 acres, or an increase of 83,000 acres. In view of the fact that the present subsidy of 13s. per cwt. less 5s. 10d. excise duty will be further reduced after next year to 6s. 6d. less excise duty for the final three years of the subsidy period, this increase in acreage may be considered gratifying, and confirms the view that the farmers are finding the beet crop one of outstanding merit in these days of depressed agricultural conditions. The factories will

indeed be more or less pressed to their full capacity, which will assist them in working on the most economical basis they are capable of. But under the influence of the TATE & LYLE regime in this country, there is an increased tendency to abandon white sugar production and be content with the production of raws. In any case, there seems no inducement at the moment to embark on the construction of additional factories, although the available beet areas in the country are by no means yet suppled with the minimum number of factories that could be economically fed.

American Sugar Periodical Amalgamations.

A development of some interest in the sugar world is the amalgamation of the three leading U.S. sugar periodicals into one publication. It may have been questioned whether there was ever room for so many, but it seems evident that since sugar prices dropped some seasons ago to an unremunerative low level, the incentive to carry on three rival publications has gradually lessened. The death some years back of Mr. DYMOND, the proprietor of the *Louisiana Planter*, left that paper in the hands of his daughter, Miss DYMOND, who carried on the publication till this summer, but then sold the paper to Mr. RUSSELL PALMER, a New York publisher of technical periodicals. Mr. PALMER, it appears, was also offered and purchased the monthly, *Sugar*, and amalgamated the two papers from the November issue of *Sugar*, retaining the latter title as the continuing one. Not content with this acquisition of two of the sugar publications, we now learn that Mr. PALMER made an offer for *Facts about Sugar*, and the proprietors of that journal (which, it turns out, was not anindependent organ but the property of the U.S. Beet Sugar Association) would appear to have accepted, for it is announced that from January 1st *Facts about Sugar* will absorb the other two papers and be published from the address hitherto associated with *Sugar*.

Some of the facts of the case have come out in the course of investigations by a Committee of the United States Senate into the extent of propaganda operations in the States, in connexion, we assume, with the "lobbying" that has taken place in American political circles over the various clauses of the new Finance Bill. Our Paris contemporary, the *Journal des Fabricants de Sucre*, has taken the trouble to wade through the official "Hearings before a Sub-Committee of the Committee on the Judiciary United States Senate," of which some 1500 pages so far have been published, and finds much in them both entertaining and unedifying with regard to the operations and manipulations of various parties concerned with the sugar question in the U.S., including the Cuban sugar interests. *Inter alia*, the ramifications of certain periodicals came up for examination. The *Journal* in its last issue remarks: "We notice, for instance, that it was admitted that . . . *Facts about Sugar* is not and never has been an independent paper, being the property of one of the aliases of the United States Sugar producers, that it has always been conducted at a considerable loss, and that very large sums indeed had to be provided by those interested, both beet and cane, in the United States and its overseas possessions." If this is the case, then it seems a not unfair inference that the sponsors of this paper which must have served them pretty well have latterly thought that the cost of subsidizing it was proving an excessive drain on their resources and that the limelight thrown on the case by the Senate enquiry was some inducement to curtail the outlay hitherto accorded it. Anyhow, the Beet Sugar Association would appear to have thought the present opportunity afforded them of disposing of the paper too

good to be lost, so the latter has changed hands and absorbed the other two sugar publications under a new proprietary. It will be interesting to see on what lines the new publication will develop, for it seems a foregone conclusion that if it is to be made to pay, and is not subsidized as hitherto, certain characteristic features on its news side will need to be curtailed. Each of the three publications now merged had its own special line, and which of these are retained will probably depend on the degree to which the new combined paper is to maintain an independent character.

West Indian Sugar Crop Reports.

The following is the gist of Barclay's Bank Reports on the British West Indies during the three months ending November. *Barbados.*—Weather conditions on the whole have been seasonable during the quarter, with frequent showers. The new sugar crop is making satisfactory growth and presents a vigorous and healthy appearance. An output of approximately 80,000 tons of sugar is estimated for next season by the Department of Agriculture. Trade which is usually slack during this period has, this year, been exceptionally dull, mainly as a result of the poor return obtained for the last sugar crop and the unfavourable market outlook for the next. *Trinidad.*—Excellent weather conditions have been experienced here during the quarter, and the young canes have been progressing favourably. In some districts appreciable damage has been done to the canes by the first and second broods of the froghopper pest, but elsewhere the infestation has not been serious. Exports of sugar for the year to August 31st last constitute a record at 80,561 tons, compared with 72,678 tons and 39,962 tons during the corresponding periods in 1927-28 and 1926-27 respectively. *Jamaica.*—During the period under review this island, generally, has been favoured with excellent rains which should prove very beneficial to the crops. The canes are reported to be looking well and the yield of the new sugar crop, the reaping of which is now due, is expected to be up to the average. Jamaican sugar planters have shown great interest in the visit of the West Indian Sugar Commission. *Leeward Islands*—The rainfall in Antigua and St. Kitts during the three months has been inadequate and the sugar canes, which earlier benefited from the August rains and were in healthy condition, have latterly shown signs of suffering from the continued hot and dry weather. Otherwise, the prospects for next crop seem favourable. *British Guiana.*—The yield of the end of the year crop now reaping is reported to be very good and original estimates are likely to be exceeded. The weather of late has been seasonable, having been hot and very dry.

Over-Production Remedies.

Dr. W. E. Cross, Director of Tucuman Experimental Station, Argentina, writes sensibly of the sugar situation. Limitation schemes in nearly all cases have failed, because of insufficient co-operation, but other more rational means are possible. A super-production crisis will solve itself, firstly, because owing to low prices business will become impossible for the less economically run concerns, these being forced to stop manufacture. At such a time as the present it behoves factories to increase their general efficiency, and lower their costs of production by exercising more control, stricter superintendence of manufacture, and better general management, not to cut down their staffs, and employ lower salaried, less efficient men. Secondly, super-production will tend to cure itself, because when the product is cheap more will be consumed.

But further than this, there is not a country where by suitable "campaigns" the consumption of sugar could not be increased, campaigns consisting not only of paid advertisements, but also of the distribution of interesting items of information on the value of sugar. Manufacturers of products, as jams, sweets, etc., using sugar largely, should likewise take part in such propaganda. Then an important matter is to increase new industrial uses for sugar, as suggested by M. A. VIVIEN,[1] viz., as a preservative, instead of salt, for making pure lime from dolomite, for obtaining pure zinc carbonate from impure calamines, for the production of acetic, lactic, formic, citric, tartaric and other acids, as well as other organic materials, and in other direct ways. Much might be done in this direction, concludes Dr. CROSS.

Argentine Production Decreasing.

According to the Monthly Review of the Bank of London & South America, the Argentine sugar crop of 1929, the reaping of which ended last October, shows a considerable reduction as compared with that of 1928, the total quantity of sugar produced being round about 327,000 tons, as compared with 375,000 tons in 1928. Assuming that consumption is up to the 1928 figure of 350,000 tons—and in all probability it will actually exceed it—it is possible that the position as regards the local market will improve, though the November quotations of \$3·10 paper per 10 kilos on wagon at the mill for moist granulated, and \$3·70 for refined (pilé) are decidedly low. But taking the long view, there is good reason to expect that in course of time the difficulties of the past three years will be removed. According to the estimates of Messrs. E Tornquist & Co., Ltd., exports for the coming year are expected to be about 23,000 tons, and taking the stocks on hand at the beginning of June as 233,000 tons there will be something like 530,000 tons available for home consumption. This estimate reckons the internal consumption for 1929-30 at 360,000 tons, which means that there will be a balance of 170,000 tons to be carried forward to 1930-31.

KIDDERMINSTER BEET FACTORY.—Kidderminster Factory is dealing with a record crop of beet this season from some seven counties, including the more distant Oxfordshire. It has now nearly reached the 14,000 acreage figure which corresponds to the existing capacity of the plant.

SUGAR IN ALBERTA.—The expansion of the sugar beet industry in southern Alberta, Canada, is such that it is likely that a second factory will be erected before very long. In 1929 the crop of beets was 20,000 tons more than in any other year since the industry started five years ago, and the 1930 crop may prove more than the existing factory at Raymond can handle.

FORMOSAN COST FIGURES.—*The Japan Sugar Trade Review* gives the following figures for the cost of production of Formosan sugar, which includes raw material, expenses of material, cost of manufacture, selling expenses, and management expenses: 1926-27, 12·05 Yen per picul; 1927-28, 9·88 Yen; 1928-29, 9·35 Yen; 1929-30, 9·15 Yen; 1930-31. 8·50 Yen. The last two years are estimates.

SUGAR FEDERATION'S NEW CHAIRMAN.—The Sugar Federation of the British Empire, the body which comprises the associations of cane sugar producers throughout the Empire (namely Australia, South Africa, Mauritius, India, British Guiana and the West Indian Islands), the British Refiners' Association, the Canadian Refineries and the British Empire Sugar Machinery Manufacturers' Association (and was originally the Sugar Section of the British Empire Producers' Organization) at its December meeting unanimously elected the Rt. Hon. L. S. Amery, M.P., as its Chairman for 1930.

[1] *Bull. Assoc. Chim.*, **29**, 421.

Tate & Lyle Ltd.

Annual Report and Meeting.

The net profits of TATE & LYLE LTD. for the year ending September 30th last showed an increase of £161,730 over the previous year at £886,582. After allocations to various reserves a dividend is paid on the ordinary shares of 15 per cent., as against 12 per cent. for the previous year, and £59,417 is carried forward. The following table, published by the *Financial Times*, gives the financial results for the past three years.

	Sept., 1927.	Sept., 1928.	Sept., 1929.
Net profit	£429,665	£724,852	£886,582
To reserves	100,000	260,000	300,000
Pref. dividend	71,500	71,500	71,500
Ord. dividend	8%	12%	15%
Forward	£45,223	£41,135	£59,417
Issued capital	4,412,000	4,412,000	4,412,000
Debenture stock	500,000	500,000	500,000
Creditors	772,108	1,065,915	832,217
Bank Loans	2,255,000	2,045,000	3,210,000
Reserves	1,392,353	1,725,233	1,946,838
Fixed Assets	4,502,219	4,618,845	5,344,754
Investments	2,630,219	2,703,799	*1,854,413
Stocks	1,535,519	1,649,902	2,619,111
Debtors	843,644	1,042,390	1,510,514
Balance Sheet Total	9,550,670	10,095,825	11,366,356

At the annual meeting the President (Sir E. W. TATE Bart.) outlined the progress the refining industry in this country has achieved since the Budget of 1928. During the 17 months following that Budget the industry has been able to expand to such a degree that it can now not only take care of the whole of the country's present requirement of refined sugar without the need to import any foreign refined, but there also exists a considerable margin of reserve to provide for any increase in consumption. Altogether, 1,300,000 tons more raw sugar has been imported for refining purposes during that 17 months, as compared with the corresponding 17 months' imports prior to the 1928 Budget; of this, the beet factories have accounted for 250,000 tons.

The increased turnover achieved and the uninterrupted working of the refineries has naturally resulted in costs of production being lowered, and Sir ERNEST TATE claimed that the consumer had benefited not only in the Budget reduction but in the lowered cost of production; for whereas the world's market price of sugar had declined 4s. 3d. since April 1928, the refined selling price had been lowered by 5s. 1½d. per cwt. TATE & LYLE's profits are reckoned to represent considerably less than one-tenth of a penny per lb. on the sugar they produce. Meanwhile foreign refined sugar has been practically driven out of this country.

Sir ERNEST TATE added that there was an increase in the number of beet factories at home turning out raw sugar only. There have been latterly four producing wholly raws, and in addition Felstead and Wissington are following suit, and TATE & LYLE have contracted to take the output of all six of these factories this season. As regards the other refineries, he mentioned that since the firm had taken over Messrs. WALKER's refinery at Greenock it had been running to full capacity and showed satisfactory results on the year's working. Then there was the purchase of the FAIRRIE refinery at Liverpool, which was now being run in conjunction with the existing Liverpool TATE & LYLE refineries and with satisfactory results also.

*Including Government securities, etc., £1,274,606.

The Sugar Industry in Brazil during 1929.

By Dr. FREDERICO W. FREISE.

In the northern States of Brazil the sugar campaign finished with the beginning of September, but the States of Rio de Janeiro, Minas Geraes and S. Paulo, just to mention the most important of the southern States, continued working and probably would not finish their milling before end of November. According to all probabilities the raw output of this year will be one of the greatest ever seen, being for Pernambuco about 5,500,000 bags of 60 kgs., for S. Paulo 1,600,000 bags, for Rio de Janeiro 1,200,000 and for Sergipe (the most important of the smaller producers) 800,000 bags. In detail the accompanying table gives all official data up to this moment available about area planted, mills run, and output delivered.

TABLE I.—GEOGRAPHICAL DISTRIBUTION OF CANE PLANTATION AND SUGAR PRODUCTION IN BRAZIL.

STATE	Total Number of Cane planters	Acres planted[1]	Cane produced Tons	Sugar mills run[2]	Industrially in these mills Sugar produced Tons (2000 lbs.)
Alagoas	1386	79,900	1,960,000	6— 9	?
Bahia	6694	64,700	?	24— 6	16,000
Minas Geraes	22,782	313,000	2,935,000	3— 2	22,000
Pernambuco	3966	128,000	4,480,000	52— 3	330,000
Rio de Janeiro	6537	44,400	876,000	36— 5	72,000
S. Paulo	9755	117,600	4,358,000	16— 2	96,000
Sergipe	626	109,000	4,080,000	6—51	48,000
Other States	?	232,000	?	38— 0	15,000
Totals	more than 52,000	1,088,600	more than 18,689,000	181—78 259	more than 599,000

The weather conditions throughout the sugar districts have been exceedingly favourable this year, especially during the maturing period when cane needs plenty of sun and well distributed moisture. Since the area of cane planted has not been increased more than 2½ per cent. compared with that planted in 1927, the actual surplus of production is due to higher yields of the cane varieties ; slowly but unceasingly the majority of the planters have come to realise that the varieties of cane used up to now, and which are unselected, must be replaced by selected varieties. Among such special varieties those recommended by the East Java Experimental Station outstand—in Brazil as elsewhere called POJ canes. According to the best information available, the acreage covered by the more important cane varieties is given in percentage in the following table, showing the ratio of the same varieties in 1925 for comparison.

The principal reason for the introduction of Java cane is its immunity from most of the diseases common in Brazilian sugar plantations—mosaic, gummosis, red rot, top rot, bark rust, and some other pests—but compared with the old varieties (among which are some handed down since the sugar industry became the principal means of livelihood among the early colonists) the Java cane is more resistant against cold nights, which is very important for the central highlands of S. Paulo ; it has a shorter vegetative period, lives three to four times longer, but is thinner and harder than the other varieties, thus needing 15-25 per cent. more labour for cutting. This is the main reason why many planters still refuse to grow it to a greater extent. Actually about 45 per cent. of all plantations are infected with one or another of the diseases mentioned above, half of all cane being totally lost.

[1] Round figures ; exact ones not available.
[2] 1st figure : Complete mills ; 2nd : not complete mills.

TABLE II.—APPROXIMATE ACREAGE COVERED BY SOME CANE VARIETIES, PER CENT.

NAME OF CANE		Al.	MG.	Po.	RJ.	SP.	Sg.	Other States[1]
		NAMES OF STATES OF BRAZIL						
Preta	1925	35	25	30	30	35	50	predominant
	1929	35	22	26	30	25	50	predominant
Rosa	1925	20	10	15	25	22	10	very frequent
	1929	20	10	13	22	15	10	very frequent
Riscada	1925	20	20	25	5	7	20	rarer
	1929	?	16	17	5	4	20	?
Sem Pelo	1925	?	8	10	?	15	?	?
	1929	?	10	10	?	12	?	?
Cayanna	1925	20	10	5	25	?	20	very seldom
	1929	20	6	5	15	?	15	decreasing
POJ Cane	1925	?	10	5	5	10	—	occasionally
	1929	5	13	8	?	14	?	increasing

Although a great amount of theoretical work has been done to discover the intrinsic causes of these diseases, only a very few convincing facts have been elucidated ; it seems that on granitic-gneissic soils any of these diseases spreads more easily than on the diabasic soils of younger geological periods ; whether the greater amount of assimilable mineral constituents of these soils is responsible for it, is as yet an open question.

As there is no legal means to compel the farmer to destroy his infected plantations, and as, generally, the infected cane is left on the root, it may be anticipated that certain of these diseases will never disappear in Brazil.

However, the fact that mechanical soil cultivation is finding its way into the sugar fields (very slowly, to say the least) is also responsible for the greater output per acre. But manuring is still something of a novelty to most of the planters, although exhaustive missionary work is done by the agricultural departments of the States and the Union.

The technical equipment in more than 90 per cent. of the mills remains on almost the same basis as a century ago. Only some eighteen or so mills can be styled completely *modern*, where generation of heat from the fuel, the efficient operation of the crushing plant, the clarification of the raw juice, the study of the thermal balance in heating, evaporation, crystallization, and insulation against radiation losses, are given due attention. All other mills on a close survey show an overall thermal efficiency of not more than 25 per cent. The available heat from the bagasse is far from sufficiently explored, since air-preheaters, economizers, and superheaters are very seldom yet to be found, and since almost 85 per cent. of all steam engines run at pressures not above 150 lbs. which involves the use of lines of steam piping of great diameter with the unavoidable consequence of great heat losses. Since there are actually 259 mills running—181 complete ones and 78 not complete, i.e. without multiple evaporators, an import value for 1928 of not more than £11,000 for sugar machinery and mill equipment shows the stagnant state of technical development, even if we suppose a big amount of machinery to be furnished by indigenous makers, mostly at Rio, S. Paulo, and Recifé.

As far as statistics show, the countries exporting sugar machinery to Brazil are as follows : United States, Germany, Great Britain, Netherlands, Czecho-Slovakia, and other countries ; a wide field for business offers itself both in machinery and in chemicals for the different stages of sugar making.

[1] Abbreviations mean : Alagoas, Minas Geraes, Pernambuco, Rio de Janeiro, S. Paulo, Sergipe. The balances to 100 per cent. are made up by different varieties of cane, such as Taquara, Manteiga, Duqueza, Canninha, Elephante and others.

The old-style production method is the cardinal point of the sugar problem in Brazil, since it governs the exorbitantly high cost of the commodity for the native consumer. Figuring production costs in Cuba mills as being 100, that for S. Paulo mills is equal to 222, that for Pernambuco 210, and that for the best sugar mills in the State of Rio 234. Brazilian sugar being generally inferior in preparation to Cuba, Java and Philippine sugars, any competition in foreign markets at a positive profit is precluded, and the only way out of this critical position for the Brazilian producer was, up to a short time ago, to look for help from Government in the form of official protection such as has been organized for Coffee. But the detrimental consequences already experienced with that unsound and artificial protection indicate what will happen if a commodity like sugar, which cannot easily be kept in stock for many months, should be protected in this way. Undoubtedly the inland consumption could be increased considerably, but only if prices decrease sufficiently; then also, the industries which use sugar as raw material would be induced to increase. The Government of Pernambuco strongly advocates the abandoning of all plantations of low output, the application of a certain amount of cane as food for cattle, and the most strictly enforced prohibition of any new plantations. But since farm crops cannot be readily re-created when once abandoned and since the Brazilian farmer loses confidence in his activities when he is interfered with by limitations and prohibitions, this policy seems wrong. The Federal Agricultural Department tries to interest the sugar mills in the larger application of spirit as a substitute for gasoline in motors, hoping to put to use in this way a great amount of inferior cane. Certainly much money which goes abroad for purchases of liquid fuel would be free for other purposes, but many technical improvements have yet to be made before spirit can be employed satisfactorily as a substitute for gasoline.

Finally, it may be mentioned that American industrials are seriously considering the manufacture of building-board from prepared bagasse in several places in Brazil. This industry certainly would do away with a great quantity of inferior cane, but would on the other side increase the production cost for sugar, since the bagasse used industrially has to be replaced by other fuel of higher price to run the mills.

Due to speculative manœuvres directed by a S. Paulo sugar industrialist, the inland prices for 1st Crystals have fluctuated between £1. 15s. 0d. and £1. 18s. 6d. per bag of 60 kilos f.o.b. S. Paulo, and between £1. 11s. 0d. and £1. 12s. 0d. f.o.b. Recifé. The exportation from June to November, 1929, amounted to 219,658 bags, the average prices being : 1st Crystals £1. 1s. 6d., Gran-fina £1. 10s. 3d., "Demerara" 19s. 8d. per bag. Alcohol was sold at 2·4d. per litre f.o.b. Recifé or Santos or Rio.

FIJI SUGAR AT GREENOCK.—What is said to be the first cargo of raw sugar to reach Greenock from the Fiji Islands was landed at the beginning of December, and consisted of 7600 tons.

ALCOHOL PRODUCTION IN ARGENTINA.—According to the Report of the Bank of London & South America, the production of alcohol in Tucuman to September 30th last was 12 million litres. The sugar mills have considerable stocks in hand, and fiscal deposits are replete. The current price is 8 cents paper per litre, without duties, but for the time being there is only moderate demand.

MAXWELL CRUSHER-SHREDDERS.—We learn that Messrs. Stork & Co., of Hengelo, Holland, who were recently granted a licence for the manufacture of the Maxwell patent shredder, have secured the order for a 36in. × 84 in. Maxwell crusher-shredder which will operate this coming season at s.f. Tjomal, Java. We understand that the milling plant of this factory is of the largest size in that island.

Utilization of Certain Nitrogen Compounds by the Sugar Cane.*

By J. H. PARDO, M.A., M.Sc., Dip.Agr.Sc.

I.—Introduction.

During the early days of scientific research, the importance of nitrogen as an essential plant food constituent became apparent. It is only in recent times, however, that we have learned about the forms in which nitrogen may be assimilated by plants. Thus, it has been found that plants may absorb nitrogen, not only as nitrates, but also in the form of ammonium compounds such as urea and other amides, amino acids, etc.[1 2 3] But our knowledge of the whole subject is not quite definite, as one may judge by the statements made on this matter by authorities such as Sir A. D. Hall. Hall, while admitting that, under conditions when nitrification is slowed down or at a standstill, " the higher plants doubtless take in the nitrogen they require as ammonia "[4] yet states that " if ammonium salts are to feed the plants they must be nitrified."[5]

It has, however, been demonstrated that some plants are not as well adapted to ammonium as to nitrate assimilation.[6] Thus, some plants are only capable of taking their nitrogen as nitrates ; while in others, the age of the plant seems to have a marked influence on the plant's capacity for ammonium assimilation.

Bearing in mind these facts, an investigation was carried out by the author with the view of determining the following points, namely :—

(1) Whether the sugar cane is capable of obtaining its nitrogen requirements from compounds other than nitrates.

(2) If so, what will be their effects on the plants, as compared with nitrate nitrogen.

II.—Procedure.

Investigations such as the present can obviously only be carried out by growing the plants under culture conditions ; that is, in a medium where the disturbing influences of chemical and micro-organic activities are absent. For the present experiment, the water-culture method was adopted in preference to the sand-culture, as the former also gives the opportunity of checking the reaction of the solutions used.

The plant material for the culture work was obtained as follows : healthy sugar cane stalks were cut into pieces at the internodes, in such a way that each piece contained one bud or " eye." All these seed pieces were then allowed to germinate in a moisture-chamber. After one week, 18 of the best were selected for the experiment ; these belonging to the varieties US 1679 and C 10.

Each plant was hung from a cork pad which had a hole in the centre, then placed in an 800 c.c. beaker, measured and numbered (from 1 to 18). In order to give them a preliminary start, all plants were kept on distilled water for a week, then their respective nutrient solutions were given to them ; two plants being allotted to each treatment.

The nutrient solutions were made of a " basal " solution, which was the same for all plants including the controls, and of a " nitrogen " solution, of

* This paper is an abstract of a thesis submitted by the author to the Faculty of Louisiana State University in June, 1927.

1 Lawes and Gilbert : *Jour. Roy. Agr. Soc.*, 1815, xii, 1-40.

2 Detmer, W. and Moore, S. A. : " Practical Plant Physiology, 1898.

3 Green, R., " Vegetable Physiology," 1900.

4 Hall, A. D. : " Fertilizers and Manures," p. 221, 1920.

5 Hall, A. D. : " The Soil," p. 67, 1920.

6 Goodale, G. L. : " Physiological Botany," Vol. II.

which the controls were deprived. As shown in the table below, basal solutions comprised all the elements essential to plant growth with the exception of nitrogen; while the nitrogen solutions were made of more or less the same weight of that element, but in different forms. The mixture of basal and nitrogenous solutions was diluted to 1000 c.c. with distilled water, and then given to the plants. Nutrient solutions were prepared fresh in this form every five days, during the whole run of the culture work.

TABLE I.

Basic Nutrients.

10 c.c.	Calcium Phosphate [$CaH_4(PO_4)_2$]	with	0·0010 grms.	of it in	solution.
10 c.c.	Magnesium Sulphate ($MgSO_4.7H_2O$)	,,	0·0008 grms.	,,	,,
10 c.c.	Potassium Sulphate (K_2SO_4)	,,	0·0020 grms.	,,	,,
1 c.c.	Ferric Chloride ($FeCl_3.6H_2O$)	,,	0·0000004 grms.	,,	,,

Total : 31 c.c. of basic nutrients, per litre of nutrient solution.

Nitrogenous Solutions.

Plant Nos.						
*1, 2,		Controls (no nitrogen)				
3, 4.	10 c.c.	Sodium Nitrate ($NaNO_3$)	with	0·001123	grms.	of it.
*5, 6.	10 c.c.	Sodium Nitrite ($NaNO_2$)	,,	0·001284	,,	,,
7, 8.	10 c.c.	Ammonium Carbonate [$(NH_4)_2.CO_3$]	,,	0·001072	,,	,,
*9, 10.	10 c.c.	Urea [$CO(NH_2)_2$]	,,	0·001120	,,	,,
11, 12.	50 c.c.	Alanine [$CH_3.CH(NH_2)COOH$] ..	,,	0·001125	,,	,,
*13, 14.	50 c.c.	Leucine [$(CH_3)2.CH.CH_2.CHNH_2.COOH$]		0·000867	,,	,,
*15, 16.	50 c.c.	Aspartic Acid ($HOOC.CH_2.CHNH_2.COOH$)		0·001127	,,	,,
*17, 18.	50 c.c.	Guanidine [$(NH_2)_2.C.NH$]........	,,	0·001350	,,	,,

Most of the nitrogenous solutions used in the experiment were made of compounds which are representatives of the various phases of the nitrogen cycle in the soil. Thus urea, a waste product of animal metabolism, is readily hydrolized in the soil into ammonium carbonate. The latter is known to be attacked by the "nitrosomonas" organisms and changed into nitrites, which in turn are transformed by the "nitrobacter" into nitrates. The amino acids, leucine, and alanine are typical products of the ultimate decomposition of proteins, and aspartic acid, the chief constituent of the nitrogenous content of the sugar cane. Three of these amino acids have been selected, because of the evidence that only some of them are beneficial to plant growth. As to guanidine, this compound was included in the test, in order to study the amount of resistance of the sugar cane to its toxicity.

At every change of solutions, colorimetric determinations were made of the *pH*, of the new and used solutions, as well as measurements of the height of the growing plants, and the number and length of their leaves. These determinations were supplemented by notes on general appearance, and photographs at the start and completion of the culture work.

After twenty days of growth in the nutrient solutions, practically all plants had developed their shoot roots and, as it was noticeable that the cane plants had so far obtained their nutrients from the seed pieces rather than from the solutions, it became necessary to separate the shoots from the seed-pieces, in such a way that their roots were uninjured.

At forty days, unavoidable troubles compelled us to stop the culture work on the plants that were feeding on amino acids and guanidine. These plants were then measured, photographed, weighed, dried, and analysed for total nitrogen by the Kjeldhal method.

*Canes of the US 1679 variety.

The remaining plants were kept for a fortnight longer and then treated as the previous ones. Therefore, they were tested for eight weeks in the nutrient solutions and the total period, from the start of the germination to the conclusion of the experiment, was nearly ten weeks.

Observations.—The only difficulties experienced with the preparation of the solutions were two, as follows. The very slight solubility of aspartic acid in distilled water : this was got over by the addition of a few c.c. of caustic soda, when it dissolved readily. The very high alkalinity of ammonium carbonate, which produced a precipitate : this precipitate re-dissolved after the solution had been in contact with the plant roots for a while ; but the high alkalinity of this solution prevented the assimilation of sufficient iron by the plants feeding on this compound, and they became chlorotic.

The growth of fungi in the amino acid solutions seriously interfered with the development of the plants on these compounds. In fact these solutions only remained clear for some hours, while the other nitrogen solutions proved at all times to be extraordinarily free from fungous infection. The quality and concentration of the basal solutions employed appeared to be entirely satisfactory to the sugar cane.

As to the general appearance of the plants during the culture work, it may be of interest to report the following.

(1) Remarkable differences occurred, particularly in their root-systems ; these differences being cultural as well as varietal. Canes of the C 10 variety proved better adapted for culture work than the US 1679, owing to the tap-root character of their system, which rendered them freer from the development of mycelia. In spite of the fact that all roots were protected from the effects of light, their colour varied from pure white to dark pink. Urea had a marked effect in the early production of set roots, and yet the development of shoot roots was considerably delayed until the seed-piece was cut off, then these roots developed at a remarkable speed, their colour being pure white.

(2) In most cases, the lower leaves of the plants grew longer than the top ones, and often failed to dry out and fall as the plant grew; this being particularly the case with the controls. The leaf sheaths of plants that fed on amino acids were abnormally large in proportion to the length of the leaf blade. It was also noticed that some plants were inclined to stool from very early age ; the sprouting buds being removed as soon as they appeared.

The colorimetric determination of hydrogen-ion concentration of the different solutions was carried out as a matter of interest and the results are here recorded.

TABLE II.

Summary of Hydrogen-ion Concentration of Solutions.

Plant Nos.	Source of Nitrogen.	Solutions when prepared.	Solutions after 5 days' storage.	Solutions after 5 days' application to the plants : at Beginning of experiment.	at End of experiment
1, 2.	Controls	*pH* 6·4	*pH* 6·4	*pH* 6·4	*pH* 6·6
3, 4.	Sodium Nitrate	6·4	6·4	6·4	7·0
5, 6.	Sodium Nitrite	6·2	6·2	6·2	7·2
7, 8.	Ammonium Carbonate	8·0	8·0	8·0	8·4
9, 10.	Urea	6·4	6·4	7·0	7·2
11, 12.	Alanine	6·2	8·2	7·2	7·6
13, 14.	Leucine	6·6	7·8	6·6	6·6
15, 16.	Aspartic Acid	6·8	8·0	8·2	8·2
17, 18.	Guanidine	8·2	8·2	7·2	7·2

It is worth noting in the above table :—

(1) The slight acidity of most of the solutions used.

(2) The great increase in pH on storage of amino acids solutions, due to the action of fungi (Nos. 11-18).

(3) The action of plants towards bringing the pH of their solution to neutrality (by selective absorption) was particularly noted at the end of the experiment, as seen on plants Nos. 1, 2, 3, 4, 5, 6, 9, 10, 17, 18.

(4) The action of fungi (towards alkalinity) combined with that of plants (towards neutrality) is best seen in Nos. 11, 12, 13, 14.

(5) The high initial alkalinity of the ammonium carbonate solution, which the plants were unable to lower (Nos. 7 and 8). Incidentally, it is curious to observe the great difference between the pH of this solution and that of its closely related compound, namely, urea.

III.—Results.

The results of the present investigation were judged on the basis of data obtained from various determinations carried out during and after the culture work. We cannot attempt to present in this paper a full report on them and we limit ourselves to a short account of each of the following items.

(1) *Development and rate of growth.*

As previously stated, periodical determinations were made (every five days) of the "height" of the various plants; using for this the distance from the base of the growing stem of each plant to the tip of its highest and longest fully developed leaf. The average figures thus obtained of different pairs receiving the same treatment, when set out on a curve, led to interesting observations. The curves of development of plants which received inorganic nitrogen and urea (Nos. 3-10) were grouped separately from those receiving amino acids and guanidine (Nos. 11-18).

Group I.—Plants of the first named group showed a remarkable uniformity in height during the first two weeks of the water-culture work; excepting those on nitrite which remained below the rest. After that period, the plants on urea and the controls showed a very great increase in height while the rest followed their regular course until the seed-pieces were cut off. After that operation, it was natural to expect the stoppage of growth of the cane plants which could not assimilate the nitrogen of their solutions, and had to rely entirely on the nitrogen stock of their seed-pieces. Such was the case, the controls ceased to grow as did the plants on ammonium carbonate, although in the latter other factors had a marked influence in causing this. Subsequently, and up to a fortnight before the end of the experiment, many irregularities were noticed; most plants showing a very severe, but temporary, reduction in their rate of growth, while the nitrite plants began to recover very rapidly. During the last period of the culture work, the majority showed a remarkable increase in height, with the result that, at the end, plants of this group could be classified in the following order:—

(*a*) Those on nitrate, which were the highest.

(*b*) Those on urea, which followed them closely.

(*c*) Plants on nitrite, which had shown at the end an appreciable increase.

(*d*) and (*e*) The controls and ammonium carbonate plants, which had altogether ceased to grow.

Group II.—As to the other group, namely, the plants which received amino acids and guanidine, their development was very slow and well below that of the controls, being very similar to that of the nitrite plants in the other group. After the seed-pieces were cut off, the sets grown on the three amino

acids, which had so far developed well together, took different courses; the leucine and aspartic acid plants kept on growing, while those on alanine showed a definite reduction in rate of growth. When the culture work on these plants had to be stopped, they were standing in the following order.

(*a*) The controls, which in spite of the fact that they had ceased to grow, were the highest.

(*b*) and (*c*) The leucine and aspartic acid plants, of practically the same development.

(*d*) Those which had alanine.

(*e*) The guanidine plants, which showed by far the poorest growth of all the plants.

The data on the " rate of growth " were obtained from the differences in height in consecutive periods, and graphs were plotted for the two groups. The determination of the " rate of growth " proved to be useful and interesting and both groups followed quite closely the same course.

On the whole, there was a very sharp increase in the rate of growth during the first week of culture work, which was followed by an equally sharp drop till the 12th day, when this drop became less severe for one week. The reduction then again became accentuated till growth stopped altogether. When this stage was reached, plants were separated from their seed-pieces and the graphs showed that the rate of growth went up again, but very steadily.

(2) *Total Leaf Length.*

The above determinations, having been based solely on the measure of height, were obviously subject to many errors. Thus, plants of equal height showed considerable variations in the number and size of their leaves, variations which could not be indicated in the height measurements.

In order to represent the development of the plants with a higher degree of accuracy, the measure of height was supplemented by what is here called their " total leaf length." This was determined by measuring the length of the blade of each leaf that was alive and fully developed in each plant, and by adding together the figures thus obtained from all the leaves belonging to the same plant.

The following table was prepared by taking the average " total leaf length " numbers of every pair of cane plants which were subjected to the same treatment.

TABLE III.

Average " Total Leaf Lengths."

	In centimetres.			As compared with control		
Nos. of days of growth:	45	50	55	45	50	55
Controls	143·5 (5)	191·0	202·5 (6)	100·0	100·0	100·0
Sodium Nitrate	185·0 (7)	260·5	365·5 (8)	128·9	136·8	180·9
Sodium Nitrite	139·5 (7)	157·0	254·5 (8)	97·2	108·3	126·2
Ammonium Carbonate	115·5 (6)	184·0	224·0 (7)	80·5	96·3	110·0
Urea	174·0 (6)	237·5	303·0 (8)	121·2	124·3	150·0
Alanine	86·5 (6)	—	—	60·2	—	—
Leucine	133·0 (6)	—	—	92·6	—	—
Aspartic Acid	125·5 (7)	—	—	87·4	—	—
Guanidine	69·0 (4)	—	—	48·8	—	—

The brackets indicate the number of developed and living leaves.

Remarks on the above Table :—

(*a*) Plants may stop increasing in height without ceasing their leaf development. Thus, the controls showed a slight increase in their total leaf length when they had ceased to develop in height.

(*b*) Great differences were observed in the height of plants which had practically the same leaf length ; such was the case with the plants on leucine and the controls.

(*c*) The very remarkable growth of the nitrite plants in the last period was also reflected in the increase of their total leaf length.

(3) *Weights and Total Nitrogen Content.*

The dry and green weights and the total nitrogen content were determined in each of the cane plants, at the conclusion of the water-culture work (the analyses were made on samples taken from the stem and leaves of each plant after they had been thoroughly mixed). The results are shown in the following Table, where figures represent the averages of each pair of plants.

TABLE IV.

	Weights in grms.		Per Cent.	Per Cent. Nitrogen in		As compared with controls.			
						Weights		Per Cent. Nitrogen	
	Dry matter.	Green matter.	Dry matter.	Dry matter.	Green matter.	Dry.	Green.	Dry.	Green.
Controls	1 557	7·187	20 26	0 1104	0·022370	100 0	100 0	100 0	100 0
Sodium Nitrate	2·982	15 980	18·66	0·2296	0·042806	191 5	222·3	207·9	191·8
Sodium Nitrite	1·875	9 577	19·57	0 2049	0 040072	120 2	133 2	179·1	185 8
Ammonium Carbonate	1 259	5 606	22·47	0·2828	0·064860	80·9	78 0	290·0	256·1
Urea	2·303	13 124	17·55	0 3514	0·063739	147·9	182·6	284·9	318·2
Alanine	0·565	3 540	15·98	0 2642	0·042098	36 2	49·2	257·3	188·0
Leucine	0·667	4·032	16·80	0·2800	0·040937	42·8	56 7	217·3	182·9
Aspartic Acid	0 602	3 192	18 86	0 3388	0·064437	38 2	44·4	306·8	288·0
Guanidine	0 533	2·579	20·58	0 2374	0 049900	34 2	35·9	210·5	223 0

Observations.—(*a*) The comparison of the figures on green weights with the corresponding figures on "total leaf length" (Table III) is particularly interesting, as it shows a close relationship, especially with the total leaf length figures at the end of the culture work. However, the comparison between the weights of alanine plants and those on aspartic acid was an exception. as the latter, while weighing less, were much better plants altogether.

(*b*) The turgidity lacking in the controls, the chlorosis of ammonium carbonate plants and the toxicity in the guanidines have largely contributed towards these treatments having the three highest percentage figures of dry matter content. While there are some striking differences in these percentages, they are all below the averages found by other investigators on analysis of sugar cane stems and leaves[1] (in all cases, over 25 per cent. dry matter in mature cane stalks), but in the early period of growth a relatively high dry matter content can only be attributed to conditions such as those found in the treatments above mentioned.

(*c*) In connexion with the subjects investigated, it is of the greatest importance to observe that the precentages of total nitrogen, on the basis of dry matter, of plants which received nitrogen as ammonium compounds, was *always* higher than those of plants which had their nitrogen as nitrate or nitrite ; but in this case again, the highest figure, namely 0·35 per cent. *N* in urea, was below the average total nitrogen found by others in analysis of sugar canes grown under field conditions. For example, the percentage nitrogen in dry matter was estimated :—

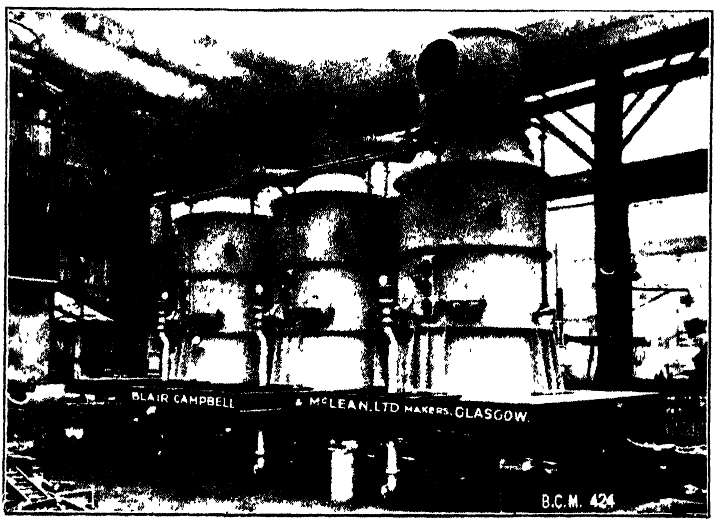
by BROWNE and BLOUIN[2] as 0·58 per cent. in stalks

by MAXWELL[3] as 0·20 per cent. to 0·59 per cent. in stalks and 0·52 per cent. in leaves ;

by AGEE and HALLIGAN[4] as 0·58 per cent. in stalks and 1·70 per cent. in leaves ;

The unusual conditions of growth found in culture work are undoubtedly the chief cause of such differences.

1 AGEE and HALLIGAN : *La Expt. Sta.*, Bull. 91.
2 BROWNE and BLOUIN, *La .E pt. Sta.*, Bull. 91.
3 MAXWELL : *H.S.P.A. Expt. Sta.*, Bull. 9, Agr. S.
4 AGEE and HALLIGAN : *La. Expt. Sta.*, Bull 91.



TRIPLE EFFECT EVAPORATOR,

10,000 sq. ft. H.S.

(*d*) The figures in the Table prove that the high chlorosis suffered by plants treated with ammonium carbonate cannot be attributed to a lack of nitrogen in these plants.

(*e*) The great differences found in the comparison of dry matter weights with their respective percentages of nitrogen content lead us to believe that a plant may assimilate a certain nitrogenous compound without deriving any benefit from the absorption of its nitrogen; such being the case of the sugar canes which received alanine.

(4) *Summary of Results and Discussion.*

(*a*) *Controls.*—Their nutrient solutions having been deprived of nitrogen, the control plants were suffering from nitrogen starvation at the conclusion of the culture work. This condition was noticeable, not by any yellowing of the foliage, but by the lack of turgidity of the leaves, the presence of red spots in them, an excessive root development and the fact that the plants had stopped growing. The red spots were not due to any pathological cause, but were a symptom of bad nutrition, also connected with the abnormal root development; this condition having been observed by SHIVE[1] when doing culture work with other plants.

(*b*) *Sodium Nitrate.*—Plants which received their nitrogen as nitrate were the best as regards height, total leaf length, dry and green weights; but their total nitrogen content was below that of plants which received ammoniacal nitrogen.

(*c*) *Sodium Nitrite.*—The results on this compound were not definite. because, on the one hand, it appeared beneficial to the sugar cane as judged by the figures on height, total leaf length, dry and green weights and total nitrogen content (all of which were superior to those of the controls); yet, on the other hand, the abnormally slow development of these plants during the major part of the test, their poor root system, the colour of their foliage (dark green excepting the growing leaves which were strong yellow) seemed to point to the possibility that a slow intoxication was occurring. In our opinion, the effects of sodium nitrite on the sugar cane may be dependent on the age of the plants (toxicity diminishing as the plant grows older), and the concentration of this compound in solution; the latter being supported by FEHER and ITVAN VAGI'S evidence,[2] that inhibition due to sodium nitrite appeared in plants when its quantity was from 1·2528 to 3·7200 grms. per litre of solution, the inhibitory effects being more marked in the roots than in the foliage of the plants. The same symptoms were observed in the present investigation, although the strength of the nitrite solution was only of 0·6320 grms. per litre.

(*d*) *Ammonium Carbonate.*—As previously mentioned, the plants fed on ammonium carbonate suffered from severe chlorosis; this condition being associated with the high alkalinity of the solution and the consequent deprivation of the plants of most of the iron in their solution.

Their figures on total nitrogen content proved that no nitrogen starvation was occurring, these figures being superior to those of the controls and the guanidine, nitrite and nitrate plants. They were just above the controls as regards total leaf length, and slightly inferior to them in height, dry and green weights; they also had ceased to grow when the experiment was stopped. In short, while it is evident that the sugar cane is able to assimilate nitrogen as ammonium carbonate, the benefits derived from its absorption have yet to be demonstrated.

[1] SHIVE, J. W.: "Study of Physiol. Balance," *Physiol. Res.*, 1915, I, No. 7.
[2] FEHER and ITVAN VAGI: *Biochem*, 174.

(e) *Urea.*—The assimilation of this ammonium compound was altogether most beneficial to the sugar cane. As regards height, total leaf length, dry and green weights, plants which received urea followed closely on those that had sodium nitrate ; while their total nitrogen content was the best of all the plants in the experiment.

(f) *Guanidine.*—In spite of the fact that the total nitrogen content of the guanidine plants was higher than that of the controls. the very low figures in height, total leaf length, dry and green weights of these plants, as well as their bad appearance, fully demonstrated the toxicity of this compound to the sugar cane.

(g) *Amino Acids.*—As already stated, plants on amino acids suffered most severely from the growth of fungi in their nutrient solutions. The fungi competed with them for the nutrients, with the consequence that their development was so affected as to put these plants below the controls in regard to height, total leaf length, and dry and green weights.

Nevertheless, the results of the total nitrogen content determination showed, in all cases, figures which were higher than those of the controls, guanidine, sodium nitrite and sodium nitrate plants. Working on other plants, LATHROP has observed that amino acids, on the whole, produced as good a development, if not better, than the nitrates.[1]

He further states that leucine and aspartic acid were beneficial to plants, while he was somewhat doubtful about alanine, it apparently being beneficial in low concentrations. The results of the present investigation did not agree completely with LATHROP'S report. Amino acids produced a development in the sugar cane which was below that of the controls and, while leucine and aspartic acid proved beneficial to the sugar cane, no profit was derived by the plant from alanine absorption.

IV.—GENERAL CONCLUSIONS.

The present investigation has made it clear that the sugar cane is able to obtain its nitrogen requirements from compounds other than nitrates. While the test failed to give a definite answer as to the effect of nitrite nitrogen assimilation by the sugar cane, it gave definite proofs of this plant's capacity for direct utilization of ammonium compounds as sources of nitrogen.

It has also demonstrated the fact that, in case of ammonium absorption, the total nitrogen content of the cane plants is well above that of plants which are fed on nitrates or nitrites ; and this leads us to the following deductions.

(1) That there is a greater assimilation of nitrogen by the sugar cane when this element is present in the form of ammonium compounds, than when it is given as nitrates ; the weight of nitrogen given being equal in all cases.

(2) That ammonium absorption, in itself, leads to a great saving of energy by the plants ; an energy which *may* be applied for purposes such as growth, instead of being lost in the reduction of the nitrates absorbed for the building up of the plants' own nitrogenous constituents.

To the above may be added the advantages derived from ammoniacal fertilizers when the sugar cane is grown in such clayey soils as would be harmed by the use of nitrate, or in a soil where available potash is deficient. In the latter case it may be unable to obtain sufficient nitrogen in the form of nitrate, while its capacity for ammonium absorption may remain unaffected, as observed in other plants.[2]

[1] LATHROP, E. C. : " Organic Nitrogen Compounds," *Jour. Franklin Inst.*, 1917 (various papers).
[2] GERICKE, W. F. : " On the Physiol. Balance of Nutr. Solns. *Am. Jour. of Bot.*, ix, 180-182.

There are several factors, however, which limit the advantages resulting from the application of ammoniacal nitrogen to the sugar cane, as follows :—

(*a*) The ammonium compounds may be temporarily unavailable to the plant ; or, if available, may produce toxicity (as guanidine) ; or no benefit may be derived from its absorption, as was the case with alanine.

(*b*) The stage of development of the sugar cane may modify considerably its preferences of nitrogen compounds, as happens with certain other plants. Thus, it is known that young rice plants are not well able to derive their nitrogen from nitrates, but thrive very well on ammonium sulphate ; while older plants can do equally well on both forms. In the present experiment, the culture work only covered a small period in the development of the sugar cane, and results have shown that, when the cane plant is young, nitrate nitrogen gives a somewhat better development to the plant than ammonical nitrogen does in the form of urea ; yet much more nitrogen is absorbed by the sugar cane in the latter form, the effects of which on the subsequent development of the plant have yet to be investigated.

(*c*) Under field conditions, the sugar cane has to compete with the organisms of the soil as regards ammonium assimilation, and probably more severely than for nitrate absorption. The result of this is that a higher amount of nitrogen in the form of ammonia may be required to produce the same tonnage of cane as is obtained from nitrates. Our experiments have shown, however, that the nutritive value to the young cane plant of one unit of nitrogen as ammonia is superior to that of the same unit given in the form of nitrate.

Note on the Lifting of Sugar Beet.

By A. W. LING, M.Sc., N D A., Dip.Agric., University of Bristol, and W R MUIR, University of Bristol.

The investigations described below were carried out in order to ascertain whether there was any increase in the sugar content of sugar beet if, after lifting the roots, they were left on the field, untopped, for a few days prior to topping and carting to the factory. It has been stated that if such a procedure is adopted, there is a transference of carbohydrate material from the wilting leaves to the roots.

Experimental.

Series A.—Five representative samples of beet were lifted on October 31st, 1929, topped and taken to the laboratory for dry matter and sucrose determinations.

Series B.—Five representative samples were lifted on October 31st, 1929, from the same field as in Series *A*. The beets were left lying in the rows with their leaves and crowns attached until six days later (November 6th, 1929), when they were topped and taken to the laboratory for analysis as above.

Series C.—Five representative samples were ploughed out on October 31st, 1929, and left untouched until November 6th, 1929, when they were pulled by hand and taken to the laboratory. It will be seen that the treatment of the beet in this series differed from that in Series *B*, in that the process of ploughing out only loosened the beet in the soil and broke off the tap root, whereas in the case of the beet in Series *B* the roots were pulled by hand from the soil, knocked together to remove adhering soil and left lying on top of the soil. The results obtained are contained in the tables below :—

Series A.—Beet lifted and topped October 31st, 1929. Samples analysed for sucrose and dry matter contents the same day.

	Per Cent. of Fresh Roots.				Per cent. of Dry Matter.
Sample No.	Dry Matter.		Sucrose.		Sucrose.
1	23·39	..	16·96	..	72·51
2	23·84	..	17·25	..	72·35
3	23·39	..	17·20	..	73·52
4	23·06	..	16·85	..	73·08
5	23·91	..	17·15	..	71·71
Average	23·60	..	17·08	..	72·63

Series B.—Beet lifted and left untopped on ground on October 31st, 1929. Left on ground for six days and then analysed as above.

	Per Cent. of Fresh Roots.				Per Cent. of Dry Matter.
Sample No.	Dry Matter.		Sucrose.		Sucrose.
1	25·25	..	18·35	..	72·68
2	25·27	..	18·35	..	72·63
3	24·95	..	18·35	..	73·55
4	25·15	..	18·35	..	72·97
5	25·27	..	18·35	..	72·63
Average	25·18	..	18·35	..	72·89

Series C.—Beet ploughed up, but not pulled out of the soil and left untopped on October 31st, 1929. Left in this condition for six days and then analysed as above.

	Per Cent. of Fresh Roots.				Per Cent of Dry Matter.
Sample No.	Dry Matter.		Sucrose.		Sucrose.
1	25·86	..	18·58	..	71·86
2	25·56	..	18·46	..	72·06
3	25·86	..	18·92	..	73·18
4	26·15	..	19·33	..	73·91
5	25·92	..	19·04	..	73·47
Average	25·87	..	18·87	..	72·90

OBSERVATIONS ON THE RESULTS.

The following observations are made, but it must be borne in mind that the experiment was a preliminary one and that climatic conditions were excellent during the time that the beet stood in the field, i.e., there was no rain or frost.

(1) There is a definite increase in the dry matter and sucrose contents of the beet as the result of leaving them in the field a few days before carting.

(2) There is a levelling up of the sucrose content of the beet when pulled out of the soil and left on the field in rows for six days before carting and analysing (see Series *B*).

(3) The percentage of sucrose in the dry matter is more or less constant under the three methods of treatment.

CONCLUSIONS.

Under favourable climatic conditions, beet that is pulled and left in the field untopped for a few days before carting and analysing appear to lose moisture, resulting in an increase in its dry matter content. This is also reflected in a higher sugar content per beet, but the weight of sugar per acre seems to remain about the same. The actual weight of material to be carted and handled would therefore be less, but it is doubtful whether this procedure is justified on account of the additional handling of the beet when they have to be pulled and left on the ground and then again handled at a later date for the purpose of topping and carting.

Cane versus Beet.

A Comment by Mr. Wynne Sayer.

In the September number of the *Agricultural Journal of India* there was reproduced the summary of the League of Nations Enquiry on Sugar that appeared in our issue of last June. This related to Dr. GEERLIGS' Report on the Production of Cane Sugar, and the Opinion of the Beet Sugar Experts on their branch of the sugar industry. In our Indian contemporary there is added an interesting Note by Mr. WYNNE SAYER which is reproduced below.

He remarks at the outset that this account of the conference makes curious reading and shows how impossible it will be to produce any permanent combination of beet and cane interests while things remain as they are.

" Dr. PRINSEN GEERLIGS' memorandum on the cane sugar world and its production costs, though in many places erring on the high side, has at once reduced the beet champions to calling evidence as regards the value of beet to general agriculture. From a sugar basis no argument apparently exists. The whole position is one of extreme gravity. Cane keeps on reducing costs, increasing yields and improving factory technique, in short, behaving like a live industry. Beet in desperation, so far from even trying for any improvements, merely builds up a tariff wall and sits behind it. It then accuses cane of over-production. The sum total of the evidence given before the League can be condensed as follows :—The cane industry as symbolised by Java continues to reduce costs, increase yields and improve factory technique, while the beet industry, in its separate national units giving up all hope of being able to produce any further improvement in yield or reduction of costs, abandons the unequal fight and retires behind a tariff wall, calling itself a key industry or whatever name is most likely to bring it the protection it requires. It is to be noted that this protection is not to enable an industry to be built up ; it is to protect an industry which before the war invaded India, and before whom Java even trod carefully.

" The position of the United States beet crop under these circumstances should be carefully watched. Here we have the beet sugar industry really at close quarters with the largest cane and sugar producer—Cuba—while between them is wedged Louisiana, whose cane sugar industry is one of the most inefficient in the world. These are the three chickens upon which the United States is brooding and she will have to hold a separate League of Nations enquiry on her own if she is to find a price for sugar which will satisfy all three *and her own consumers*. She has lent Cuba money to such an extent that she claims a substantial share in the sugar industry. She is propping up the crippled cane industry of Louisiana as an internal industry to be fostered for the sake of the farmer. Last but not least she is being urged to support home industries by raising a tariff wall against Cuba for the sake of the expansion of her own beet industry. Under such circumstances the action taken by the United States may well give a lead to the League enquiry. The fact that the American farmer does not like beet or any other crop he has got to do hand labour in, matters nothing. The fact that " curly top " limits expansion South equally is disregarded, but the final fact that any alteration of the immigration laws would extinguish the U.S.A. beet industry may possibly result in an alteration of present ideas, as virtually all the actual field work is done by immigrants.

"The facts in U.S.A. are equally true of Europe; beet field costs will not come down, the increase in the standard of living has seen to that. Factory improvements cannot cope with rise of costs elsewhere. Crop yields will not rise unless cultivation is of the highest class. Countries must face facts. They can keep their beet sugar industry as they keep their botanical gardens, but not as an open competitor in an ever expanding world industry."

Steam Economy in the Operation of Sugar Factories.[1]

By J. W. MONTGOMERY.

In many cases much more intelligent control could be had if an analysis were made of the steam distribution, and where close control is needed, the cost of the necessary instruments for the determinations required is negligible in comparison with the results that can be secured. Even when these are not available, however, information worth while can be secured by means of a few simple calculations.

As an example, let us assume: 1000 tons of cane per day grinding capacity; 13·5 fibre per cent. cane; 75 purity residual juice; 1·5 polarization bagasse; 41 moisture in bagasse; 1150 tons mixed juice; 13·5 Brix mixed juice; 11·5 polarization mixed juice; 85·2 purity mixed juice; 13·3 Brix clarified juice; 86·2 purity clarified juice; 2·5 per cent. press cake on cane; and 4·5 per cent. available steam per 1 per cent. fibre in cane.

Maceration Water.—The steam required to heat 1000 tons of juice from 85 to 212° F., asssuming the juice to have a specific heat of 0·9 and the heating efficiency to be 95 per cent., would be:

$$\frac{0{\cdot}9 \times 2{,}000{,}000 \times 127}{970{\cdot}4 \times 0{\cdot}95} = 247{,}970 \text{ lbs. F/A } 212 \text{ F.}$$

The following table gives the steam required to heat 1000, 1150, and 1200 tons of juice from initial temperatures of 85°, 90° and 95°F.

POUNDS OF STEAM F/A 212°F.

Tons Juice.	85°F.	90°F.	95°F.	Lbs Saved 85-95°F.
1000	247,970	238,200	228,450	19,520
1150	285,170	273,940	262,710	22,460
1200	297,560	285,850	274,140	23,420

It is thus seen that there is a saving to be made in applying maceration water as hot as is available. There are also the additional advantages of extra evaporation of moisture from the bagasse before it reaches the furnaces, and, many believe, better extraction at the mill.

As indicated in the table, the quantity of maceration water used has a material effect on the steam consumption at the heaters. If we assume 4·5 per cent. steam on cane per 1 per cent. fibre in cane, then from 1000 tons cane there would be available 1,215,000 lbs. steam. At a grinding rate of 1000 tons cane per 24 hours, this would be 50,625 lbs. per hour. Since it requires 247,970 lbs. steam to heat 1000 tons juice from 85 to 212°F., and 297,560 lbs. for 1200 tons, the extra steam required would be 49,590 lbs., or practically the amount generated during an hour. Good admixture and care in avoiding large fluctuations in the appl.caton of maceration water would effect a substantial saving

1 Abridged from *Reports of the Association of Hawaiian Sugar Technologists*, 1929.

Presses.—The filter-press station is notorious for loss of heat, but not much can be done to remedy the situation except the use of hot water and care in its use. WALTER SMITH has pointed out that much more effective work can be done at the presses by filling at not exceeding 25 lbs. per sq. in. and washing at about 40 lbs. Such pressures would have the additional advantage of less chance of leakage and a consequent saving in water to be evaporated.

The following method (open to certain objections) will give an approximate idea of the quantity of water introduced between the mixed juice and clarified juice. It is applicable only when no products, such as low grade sugar have been returned to the juice, and when due provision has been made to prevent evaporation of the clarified juice sample. It is best illustrated by an example taken from the data assumed previously :—

$$\text{Tons water in mixed juice : } \frac{1150 \times (100 - 13{\cdot}3)}{100} = 994{\cdot}75.$$

$$\text{Tons clarified juice : } \frac{132{\cdot}25 - 0{\cdot}50}{0{\cdot}1146} = 1149{\cdot}19.$$

The figures in this equation are obtained as follows : 132·25 tons polarization in mixed juice from 1150 tons of mixed juice of 11·5 polarization (1150 × 0·115) ; 0·50 tons polarization in press cake, from 2·5 per cent. mud on 1000 tons cane, mud having 2·0 per cent. polarization (1000 × 0·025 × 0·02) ; 0·114646 — polarization of clarified juice from product of Brix and purity) 0·133 × 0·862).

$$\text{Tons water in clarified juice : } \frac{1149{\cdot}19\,(100 - 13{\cdot}3)}{100} = 996{\cdot}37.$$

Tons water added : 996·37 — 994·75 or 1·62 tons.

Below is a summary of similar calculations at various densities with the corresponding amount of steam required in each case :—

Brix Clarified Juice	13·30..	13·00..	12·80..	12·60
Purity Clarified Juice	86·20..	86·20..	86·20..	86·20
Tons Clarified Juice	1,149·19..	1,175·71..	1,1[illegible]4·08..	1,213·03
Tons Water in Clarified Juice	996·37..	1,022·87..	1,041·24..	1,060·19
Tons Water in Mixed Juice	994·75..	994·75..	994·75..	994·75
Tons Water Added	1·62..	28·12..	46·49..	65·44
Tons Press Cake	25·00..	25·00..	25·00..	25·00
Tons Water per Ton Mud	0 06..	1·12..	1·86..	2·62
Brix Syrup	65·00..	65·00..	65·00..	65·00
Tons Water Evaporated	914·07..	940·57..	958·97..	977·94
Lbs. Water Evaporated per lb. Steam taken as	3·75..	3·75..	3·75..	3·75
Lbs. Steam required	487,500..	501,640..	511,450..	521,570

The quantity of steam required has been estimated and includes that required for evaporation in a quadruple effect as well as re-heating the juice. Close calculating would show an extra amount needed for the latter purpose with increasing amounts of press water.

Evaporation.—The effect of the density of the syrup on steam consumption is well known, but in operating it is sometimes forgotten in the desire to use more maceration water at the mill, to grind faster in order to produce more bagasse, or to reduce losses at the presses. The following table will give a general idea of the quantity of steam required with syrup at various densities :—

Brix Syrup	65·00..	64·00..	63·00..	62·00
Brix Clarified Juice	13·30..	13·30..	13·30..	13·30
Tons Clarified Juice	1,149·19..	1,149·19..	1,149·19..	1,149·19
Tons Water Evaporated	914·07..	910·39..	906·60..	902·69
Lbs. Water Evaporated per lb. Steam taken as	3·75..	3·75 ..	3·75..	3·75
Lbs. Steam required at Evaporators	487,500..	485,540..	483,520..	481,430
Lbs. Steam required at Pans	193,770..	203,150..	212,730..	222,690
Total Steam : Pans and Evaporators	681,270..	688,690..	696,250..	704,120

Brix Syrup	61·00..	60·00..	59·00
Brix Clarified Juice	13·30..	13·30..	13·30
Tons Clarified Juice	1,149·19..	1,149·19..	1,149·19
Tons Water Evaporated	898·67..	894·41..	890·16
Lbs. Water Evaporated per lb. Steam taken as	3·75..	3·75 ..	3·75
Lbs. Steam required at Evaporators	479,290..	477,020..	474,750
Lbs. Steam required at Pans	232,950..	243,550..	254,430
Total Steam : Pans and Evaporators	712,240..	720,570..	729,180

In estimating the requirements at the pans in the above table, the total quantity of syrup was assumed to be evaporated to 96° Brix, and an allowance was made for heating 35°F. A pan factor of 1·2 was used.

Thus : 1149·19 tons clarified juice less 914·07 tons water evaporated leaves 235·12 tons syrup or 470,240 lbs.

Average pan and syrup temperatures taken as 145°F. and 110°F. respectively

Heating 470,240 × 35	1,645,800 B.t.u.
Evaporation 151,800 × 1021·4	155,048,500 B.t.u.
Total	156,694,300 B.t.u.
× Pan Factor 1·2	188,033,200 B.t.u.
Lbs. Steam F/A 212°F.	193,770

Heating requirements would be somewhat greater than the figure taken on account of cooling of molasses and low grade sugar.

To summarize :—

Tons Mixed Juice.	Heaters (Initial Juice Temp. 85°F.)	Evaporators (Syrup 65 Brix)	Pans	Total
1000	247,970	407,500	193,770	849,240
1150	285,170	487,500	193,770	966,440
1200	297,560	514,170	193,770	1,005,500

In addition to the above, a liberal allowance should be made for radiation, stoppages, reserve fuel, cleanout periods, power, etc.

Against the steam consumption, we can now balance the available steam. As in the previous calculations, it is assumed as 4·5 per cent. on cane per 1 per cent. fibre in cane.

Fibre Per Cent. Cane.	Lbs. Steam Available per 1000 Tons Cane.
10·0	900,000
11·0	990,000
12·0	1,080,000
13·0	1,170,000
14·0	1,260,000

Each factory will, of course, have to work out figures for the steam requirements, depending on the equipment and method of operation at each station. This should not prove to be difficult, however, after a period of careful observation and recording of data. The same would be true of the steam available under ordinary working conditions. Even such elementary figures as pounds water in mixed juice per pound bagasse, when considered together with the density of the syrup, will give valuable information from a practical operating standpoint.

Recent Work in Cane Agriculture.

LES PROGRES RÉALISÉS EN AGRICULTURE A L'ILE MAURICE. Communication faite à la Chambre d'Agriculture. **P. De Sornay.**

In a recent reference to sugar cane cultivation in Mauritius we ventured to remark that the work which had been done there was less widely known than it deserved to be.[1] And this has led to the happy result that DE SORNAY has written a paper with a wealth of detail as to the length of time during which certain useful practices have been conducted there. This record is very instructive; but it has been forwarded in type-script, and we are left in doubt whether it has been printed locally. Anyhow, it would appear that DE SORNAY presented a paper at the recent Java Conference on the same subject: for the moment, then, a short summary of the paper will have to suffice.

It opens with a statement that J. DE SPEVILLE, a local manager, has shown that the rendement of canes per arpent in Mauritius compares favourably with that in Hawaii on unirrigated land and with that in Java— if new bases of comparison are instituted; and that this gentleman is devoting himself to the work of elucidating the data. The subject is not pursued, beyond indicating two of the factors to be considered, namely, that Mauritius is situated in the hurricane region, and that its soils are inferior in food value to those of the great sugar countries. On the other hand, all of the evidence is held to show that the agricultural practice in Mauritius is in no way inferior to that elsewhere.

The author then proceeds to enumerate the directions in which Mauritius has initiated important improvements in the cultivation of the sugar cane in the tropics. Comparisons are of necessity instituted, and the purport of the author appears to be that certain practices, now receiving attention here and there, have long been known and practised in the island, and the following are dealt with in succession. Shoots left in the field at harvest (the new ABREU system in Cuba); molasses used as manure (now under discussion in various countries): molasses as fuel (considered as a novelty in the *International Review of Agriculture* in September, 1928): green manuring (whether by digging in crops grown before planting the cane, or by interlining leguminous crops during the growth of the cane): farm yard manure (prepared artificially or with the minimum of cattle): digging in the cane trash (recently receiving so much attention in ratoon cultivation in Cuba): the soils (their comparative analysis in certain countries tending to show that those in Mauritius are in general naturally inferior).

This is all very interesting reading. Records of various kinds are utilized to give precise dates for the initiation of each practice, and in this way the paper will prove to be a valuable document for reference. There may be a tendency rather to overstate the case regarding certain practices, for DE SORNAY naturally includes as many as he can bring to mind. It would be interesting, for instance, to have similar data prepared concerning the introduction of burying the trash and of green manuring (in both the ways mentioned) into the British West Indies, where the sugar cane has been grown more or less intensively since 1640-1650 A.D. Our impression on visiting the West Indian Islands in 1891 was that such methods had long been an integral part of the local agriculture, if not so for centuries. The use of leguminous plants in agriculture and the practice of green manuring are of course by no means new within historical times; it is recorded that the latter was known and practised in the indigenous Indian agriculture during the mediaeval

[1] *I.S.J.*, 1928, 414.

period (600 B.C. to 1200 A.D.). But these and other matters brought forward in this interesting paper may be left until it is possible to deal with it more fully.

Annual Report of the Insular Experiment Station of the Department of Agriculture and Labour in Porto Rico, 1927-1928.

As is usual, a great mass of work is recorded in this document. But although the sugar industry is the mainstay of the prosperity of the island the Report covers a much wider field. The animal industry and the whole of the crops grown are cared for by the staff of the Station which, moreover, finds time for serious studies of the natural history of Porto Rico, including the ecology and classification of various groups of plants and animals. The latter studies appear to depend on the personnel for the time being, and thus we have valuable contributions to the study of the flora and fauna, in some cases altogether apart from their agricultural bearing. The other crops regularly reported on are coffee, tobacco, cacao, coconut, cotton, besides the chief tropical fruits and vegetables, the fruits especially being extremely important as export crops to the mainland of the United States.

A formidable list is given of papers published by the staff during the year, including fifteen in the local Journal of the Agricultural Department and a considerable number in Spanish in the Revista. Two of the "papers" stand out because of their very bulk. The first is an Ecological Survey of the Flora of Porto Rico by M. T. COOKE and H. A. GLEASON. This appears to be a work of some importance and great scientific interest, and extends to 139 pages of print with 75 excellent Plates. The second, a Monograph of Sugar Cane Varieties by A. H. ROSENFELD, runs to 334 pages and is illustrated by 27 Plates. This monograph we have already reviewed.[1]

Turning to the administrative section, we note that two posts became vacant during the year and had not been filled at its close. The Director, E. A. LOPEZ DOMINGUEZ, accepted an appointment in Peru, and one of the Assistant Pathologists apparently accompanied him. The post of Chief Entomologist still remains vacant. These losses are serious, but when we turn to the list of officers usually published in this Report, there are grounds for assuming that the staff is in a thoroughly healthy condition. All the rest of the 30 listed officials appear to have put in 12 months' work during the year. This is a very satisfactory state of affairs, in that it tends to show that the dry rot of short terms of office in the Insular Experiment Station has at length ceased. This matter has been frequently referred to in these pages, and readers may learn how serious it has been in the past by referring to page 131 of the 1925 volume. Of course it was a question of inadequate appropriations for the salaries of the staff, but the constant changes reacted most disastrously on the character of the work turned out. It is therefore interesting to read that the appropriation for the coming year has been raised to $130,000 "which makes possible the employment of additional members of the staff and expansion and intensification of experimental work."

Less than half of the Report deals with the sugar cane, and this work was chiefly carried out in the Divisions of Agronomy and Chemistry. In the former Division a very extensive series of experiments on different estates throughout the island has been commenced, for the purpose of selecting alternative varieties to the Uba cane in the semi-arid regions and those parts liable to mosaic disease. The results of this piece of work will not be fully available for two years more, but it is interesting meanwhile to note that, in

[1] *I.S.J.*, 1927, 584-587.

the crops reaped in March 1928, both Co 213 and POJ 228 did better than Uba. In another experiment Co 213, Co 218, POJ 2714, D 1135, and Uba were the most promising.

A second problem attacked was in connexion with the standard canes, BaH 10 (12) and SC 12 (4), to see if there were better canes available for Porto Rican conditions. In one experiment, B 417 out-yielded both these canes in field and milling qualities, while B 425 and EK 28 were close behind them, and in another experiment six Porto Rico seedlings were compared with the two standard canes, Co 281 and Badila, but the results are not yet available. These examples will suffice to give an idea of the character of the work being done, and the hopes of a successful issue in the two projects mentioned. A bewildering number of other experiments, with special classes of canes—perhaps too many—are detailed, including numbers of Porto Rico Seedlings, many of the POJ seedlings, 24 Barbados seedlings, Co seedlings, mosaic resistant and tolerant kinds, and so forth, these also being conducted on various estates. Meanwhile, it is satisfactory to note that the raising of seedlings is not being neglected, and some of these are turning out to be very promising.

In the Division of Chemistry, which is obviously under-staffed, besides heavy routine soil work, all the canes were analysed for the Division of Agronomy; and in addition a number of experiments were conducted on different estates. The more important subjects investigated appear to be the following: the effect of fertilizers on the juice of the sugar cane, building up a complete fertilizer for different types of soil, the relative value of sodium nitrate and ammonium sulphate for Porto Rican conditions, and the sequence of these two, the complete manure and the nitrogenous. A study has been commenced on the organic matter in the soil, e.g., the effect of trash on nitrification under different conditions and the effect of trash on legumes. Lastly, following statements of the increase of sucrose in the beet by the application of manganese, its effect on sugar cane was studied. Analyses showed that manganese was present in cane leaves and juice, and applications of soluble manganese salts and ore were found to produce a negligible effect on Uba juice, although germination was stimulated.

Experiencias sobre la Canne POJ 2725. **C. E. Chardon** (with an English summary which is here drawn upon). *Estacion Experimental Insular, Boletin* No. 34, 1928.

While fully recognizing the risks involved in attempting to draw conclusions from experiments conducted for one year, the author suggests that mill-owners and colonos may with advantage test this new cane, now that the season for planting it, *gran cultura* or autumn planting, is approaching. He then summarizes the conclusions arrived at and recommendations made in the Bulletin.

(1) POJ 2725 was imported to Porto Rico from Argentina in June 1923, where it had been giving good yields, and had proved almost immune to mosaic.

(2) It very promptly proved in Porto Rico its great resistance to mosaic, and was rapidly propagated throughout the western coast, where many car-loads were ground with satisfactory yields. It also showed its character of early flowering in November. It was planted in *gran cultura* in 1926 over 200 to 300 acres and harvested in 1927-28 and the crop reaped forms the basis of what follows.

(3) All the plantations bloomed profusely, with a marked drying of the tops and a corresponding loss in weight of this part of the cane. On one estate

this loss in weight averaged 16·19 per cent. in 19 fields occupying 151·33 acres, and a similar loss was noted on other estates. It was noted that the loss was greater in ratoons than in *gran cultura* ; in fact, it was progressive, increasing with age, in some cases reaching 46·03 per cent. These two facts, its early flowering and the loss in weight of its terminal portion, are its chief drawbacks. The cane should therefore never be planted as *primavera* (spring planting), but always as *gran cultura*, and it should be cut as early as possible in December or January, so that the ratoons will have time to develop their tonnage.

(4) In the estate mentioned above, the average yield of the 151·33 acres was 45·80 tons of cane and 5·11 tons of sugar, exceeding Ba H 10 (12) on similar land, and also showing the advantage of not suffering from mosaic. Plantings made in August gave heavier yields than those made in October. On another plantation lower yields were produced, because of the frequent flooding of the low-lying lands, but it compared favourably with the other canes planted there as follows: POJ 2725 gave an average of 4·20 tons of sugar on 85·50 acres, SC 12 (4) 4·10 tons on 142·29 acres, and POJ 36 2·14 tons on 134·83 acres.

(5, 6) No conclusive evidence is as yet available regarding ratoons, but the few facts recorded are favourable. In one district seven fields of 17·54 acres produced 28·5 tons of cane and 2·95 tons of sugar per acre "fairly good for that district." On another estate 6 acres of first ratoons without irrigation yielded 29·17 tons of cane and 4·4 tons of sugar per acre. There appears to be no reason whatever why POJ 2725 should not succeed when ratooned, provided that the crop is reaped early in the season.

(7) It upheld, under Porto Rico conditions, its Argentine reputation of resistance to deterioration after cutting. Grown in similar conditions, POJ 2725 retained 98·09 per cent. of its sugar 13 days after cutting, 98·92 (sic) after 21 days, and 88·31 after 28 days; while the corresponding figures for Ba H 10 (12) were 90·72, 65·26 and 40·17 per cent. It can be affirmed that POJ 2725 resists deterioration more than any other commercially grown variety in Porto Rico.

This summary ends as follows : "In conclusion the author wishes to express here his belief that at the present time the POJ 2725 is a cane variety of great importance to the sugar industry of the Island, recommending that it be widely propagated but within the limitations already discussed in this Bulletin. To carefully follow this plan would contribute in a great measure toward solving the great problem we are all engaged in, namely, the reduction of the cost of production through an increase in the yield of sugar per acre. It represents the great economic problem of our sugar industry, and also at this time of general crisis, the fundamental problem which all the sugar producing countries of the world are now facing."[1]

NOTES ON PORTO RICAN HOMOPTERA. **Herbert Osborn.** *Journal of the Department of Agriculture*, Porto Rico. Vol. XIII, No. 3, July, 1929.

This paper contains descriptions of insects of the frog-hopper class collected throughout the island by an American entomologist, but chiefly among the sugar plantations on the south coastal plain. Such studies are now becoming increasingly necessary because of the part played by such leaf sucking insects, not only in weakening the cultivated plants, but in the spread of such diseases as mosaic. We are not concerned here with the details of classification which form the body of the paper, however important or interesting they may be ; but anything connected with the natural history, distri-

[1] See *I.S.J.*, July, 1929, p. 367, for a comparison between POJ 2725 and POJ 2878, to the disadvantage of the former. It must be noted, however, that the canes were planted in *spring*.

bution, means of dispersal, or relative abundance may be of serious import to the sugar cane industry. The great bulk of the species have settled down into a static condition and are comparatively harmless, but we have no certainty that this will always be the case, and there is special danger of new forms being introduced, with fresh and abundant food provided for them. For there have been occasions when leaf sucking insects, without warning, have suddenly increased enormously in their numbers; and without knowledge of their habits or even their names, the plant growers have been reduced to helplessness until this knowledge has been obtained and appropriate remedial measures introduced.

An interesting comparison is drawn as to the numbers of species in the larger islands of the Caribbean Sea. In spite of much greater attention given to them in Porto Rico, it has a much smaller known homopterous fauna: 72 have been named and few additions may be expected, while with little collecting 100 have been obtained in Jamaica and in Cuba 180; and the author is convinced that the Homoptera in the island of San Domingo and Haiti will also greatly exceed the total for Porto Rico. The author points out that the species of Homoptera throughout the tropics appear to have been distributed by man, because they are chiefly found on cultivated plants and grasses used for fodder. The natural means of migration is obviously connected with wind, and from its position little can be expected from other islands. Besides which a striking picture is drawn of the violence of the winds in the island and their probable destructive effect on such small insects. The following condensed account of the island has this in view and is worth repeating for those unacquainted with it.

"Porto Rico lies within the tropics from 17° 15′ to 18° 15′ north latitude, is about 110 miles long from east to west and 40 miles wide from north to south There are a number of mountain ranges occupying most of the island, separated by fertile valleys and with a coastal fringe of 5 to 10 or 15 miles. The land is largely under cultivation even to the tops of many of the hills and lower mountains and consequently the areas of endemic vegetation are very much reduced. The prevailing wind is east to west and of almost constant occurrence with velocity running up nearly to gales. Rains are of almost daily occurrence in the mountains and frequent in the north part of the island but less frequent in the south part. A part of the south-west section is almost arid, the rain being almost totally absent in the dry season and infrequent during the entire year. It is quite to be expected, therefore, that there should be considerable variety in the vegetation of different localities and necessarily much variety in character in insect life."

The author considers that the Homoptera, and especially the leaf-hoppers, have a precarious hold in Porto Rico, and a stormy life. The existing species are comparatively innocuous, but there is no saying how newly introduced forms will react to the local conditions. The leaf-hopper which did so much damage in Hawaii more than a quarter of a century ago has not yet been met with in the Caribbean, and the Trinidad species is not present in Porto Rico (and it may be added that both of these countries are free of hurricanes).

SEEDLINGS. **J. L. Nicholl.** *Reports of the Association of Hawaiian Sugar Technologists.* October, 1929.

The introduction of foreign canes into Hawaii as parents for seedlings is steadily proceeding. The present practice is to grow such canes for one year at the greenhouses of the United States Department of Agriculture, situated at Arlington in Washington, D.C. "Provided no disease or insect infestation

has evidenced itself during this period, cuttings are washed of all dirt ; soaked in hot water of 50°C. for 20 minutes to eliminate *sereh* ; dipped in 95 per cent. alcohol for 10 seconds ; followed by immersion in a 1 to 1000 mercuric chloride solution to kill surface fungi or bacteria. Following this, the cuttings are washed to remove the mercuric chloride and packed in sealed containers for shipment to Hawaii." On arrival in Hawaii the seed containers are opened in the quarantine room at Honolulu, the cuttings are inspected and all dead material removed : they are washed, placed in sealed containers and sent to the quarantine station at Kanoa, on the small island of Molokai. Here, the cuttings are planted in quarantine house No. 1, and grown till the entomologists are satisfied that there are no insects on or in them. Then they are stripped, cleaned, and planted in quarantine house No. 2, adjacent to standard canes. They are observed closely by pathologists for nine months, until it is evident that they carry no disease which will attack the standard canes. They are then planted in the ground, again close to standard canes, at Kawela in the same island ; and kept under observation till released by the Committee in charge, for plantation distribution. A list is given of varieties introduced since strict quarantine arrangements have been in force : 4 in 1923, 13 in 1925, 8 in 1926, 1 (POJ 2878) in 1927, and 6 in 1928.

During the 1928-1929 seedling season, about 800 parent combinations were made. A careful count is kept of seedlings produced by each combination, so as to be able to separate those producing few or many seedlings Thus, three crossings are known to produce seedlings freely, namely, Yellow Caledonia × H 109, Uba × H 456 and POJ 213 × H 456 ; while nine other combinations have been proved to produce few seedlings.

A list is printed of the numbers of seedlings raised during the year at Makiki in Oahu, and grouped roughly according to the dominant strains : about 30,000 with Kassoer, Chunnee, Uba and Yellow Caledonia blood, and 23,147 with various noble canes as parents. All crosses were made with the male tassels kept alive in 0·03 per cent. sulphurous acid solution, and some with the females as well. On comparing the germinations obtained by the two methods, where the female arrows were cut, 14·5 and 16 per cent. of the combinations produced over 50 seedlings, as against 32 per cent. where the female arrows were left attached to the cane plant. Makiki station supplied the plantations on Oahu with seedlings, Maui has its own station which provided 12,000, and Hilo supplied 31,000 seedlings for use in Hawaii. In Kauai there is no station, but a few seedlings are raised locally on individual plantations.

The great bulk of the crossings are made at Makiki, and shipped to the other islands as " fuzz " from which the seedlings are raised. Formerly the fuzz was distributed to the estates, but now that central stations have been provided the seedlings are raised on them. It is considered that the staffs on the plantations should be relieved of this highly technical work. When the seedlings are large enough they are potted up, and they reach the plantations at this stage of development. The whole of the selecting work for any plantation is carried out by its own staff.

It was noted in our last year's article[1] that the characteristic feature of the Hawaiian seedling programme was the enormous number that are grown to maturity, and that this has been made possible by the active participation of the plantations in the work. But this involves the locking up of a considerable percentage of land which should be growing commercial sugar cane. True, almost all the seedlings grown are available for crushing with the rest of the crop ; and, as selection proceeds, the seedlings will more and more approximate,

[1] *I.S.J.*, 1929, 68.

in the quality of their juice, to the standard canes grown. But in the earlier stages of selection, before the inferior types have been eliminated, the average juice of the mill will suffer in quality. It is essential, therefore, that this stage should be passed through as quickly as possible, and this may be regarded as the chief problem presented by the Hawaiian method.

Many efforts have been made, in various countries, to detect in young seedlings characters which are correlated with the quality of the juice in the ripe cane, but these have ended in failure. It is believed that a definite advance has been made in Hawaii in this direction, in that it is possible to make a selection among the potted seedlings before they are put into the ground on the plantation. This is the outcome of studies made at Makiki, where most experience has been gained in seedling technique. It is claimed "that we can safely eliminate between 10 and 14 per cent. of the potted seedling canes at this stage, with little risk of losing those desired." This practice is now spreading to the plantations, and one case is mentioned where the local staff is quite enthusiastic in the matter.

For the rest, debatable points occur all along the line of selection, which is natural and all to the good, where the whole body of planters is personally engaged in the work. To take one example, the age at which the first selection should be made among the potted seedlings after planting out : there are advocates for doing this after six months' growth, after 12 months, and when the canes are ripe. At Makiki no definite age is chosen, and the selection is made at the latest period when each individual seedling can be studied to advantage in all respects : this means at an age varying with the character and conditions of growth, which usually lies between 8 and 14 months. The estimating of ratooning power has difficulties of its own. But it is obvious that all of these preliminary selections depend solely on powers of observation and experience, and this throws a heavy burden of responsibility on the shoulders of the staff. One important aid can be obtained from a knowledge of the parentage of the seedlings ; and it is emphasized by the author of the Report that seedlings should be asked for whose parents have in the past established a record of usefulness for the particular conditions of soil and climate in which the plantation is located.

The cane tract of the Territory has been divided into four regions according to the predominant standard cane variety, namely, the regions of H 109, Yellow Caledonia, D 1135, and Yellow Tip. The H 109 regions are found in Kauai, Maui and Oahu, and the plantations are mentioned where this cane is the standard : similarly, Yellow Caledonia regions are enumerated for Hawaii and Maui, D 1135 regions for Hawaii and Kauai, and Yellow Tip for Kauai. The newer seedlings are also being studied in a similar manner, and a Table is printed with the answers to a questionnaire received from about 25 plantations as to their opinions on 25 of the more recent acquisitions. One of the most interesting points in this Table is the popularity of POJ 36 : it easily leads as a favourite, the next in favour being POJ 2714, with POJ 213 third. The author concludes : "POJ 36 is our greatest 'find' in late years. Reference to the preceding chart will show its widespread popularity. On unirrigated lands it is displacing standard canes on all types of soil, while on irrigated areas it is being widely spread on poor areas."

C.A.B.

Beet Yields.—For the years 1901 to 1913 the average yield of beet in different countries in tons of 2240 lbs. per acre was : Holland, 12·21 ; Germany, 11·28 ; Belgium, 10·95 ; and France, 9·88. During the period 1920-1925 the corresponding figures were : 12·38, 9·79, 11·24 and 10·29 tons.

Apparatus for the Drying of Bagasse.

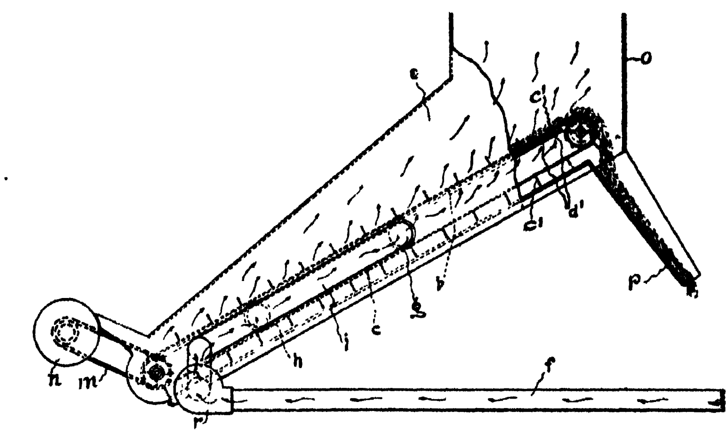
Practical Fuel-saving Invention.

By HENRY W. HOLGATE.

A new method of drying bagasse has just been perfected in the West Indies, by means of which the mill conveyor is converted into a continuous dryer, flue gases being utilized for carrying away the moisture. This apparatus has had great success in a factory in Jamaica, where it has solved the fuel problem, giving bagasse to spare. Patents have now been secured nearly all over the world.

In the United Kingdom patent recently published,[1] it is pointed out that the bagasse in its green, more or less wet state is often subjected to heat for drying purposes ; but the apparatus hitherto used has been inefficient because of a lack of means for causing the hot drying gases to percolate the mass, the moisture thus being insufficiently expelled. The object of this invention is to subject it to a drying treatment while still on the conveyor so as to convert it into an efficient fuel ready to be effectively burned. After the treatment the conveyor may deliver the dried material directly into the furnaces or to any point for distribution later to the furnaces.

A conveyor housing, comprising a chamber enclosing the space above and below the conveyor is employed ; and a perforated top deck, above which the conveyor causes the green bagasse to slide, is added. This top deck is perforated. Hot flue gases from any available furnace are introduced under



pressure into the chamber below the top or bagasse-carrying deck, which hot gases may be introduced at one or more points along the conveyor according to the depth of material being conveyed. The gases pass upwardly through the perforations, enter the bagasse, penetrate it, and then pass out to the atmosphere through the open upper end of the housing, thus carrying away the moisture.

The invention is best understood by the example illustrated in the drawing, in which the conveyor comprises a looped chain *b*, *c*, having a series of conveyor flanges c^1 perpendicularly rigidly mounted thereon. Beneath the top length of the chain and in supporting relation thereto is a perforated deck-plate d^1. A housing *e* encloses the deck and presents a chamber enclosing the top and bottom sides of the conveyor. The hot flue gases are delivered under their natural or supplemented pressure by a pipe *f* to the portion of the chamber below the deck ; and a series of branches of this pipe distribute the

[1] No. 317, 172, dated June 14th, 1928.

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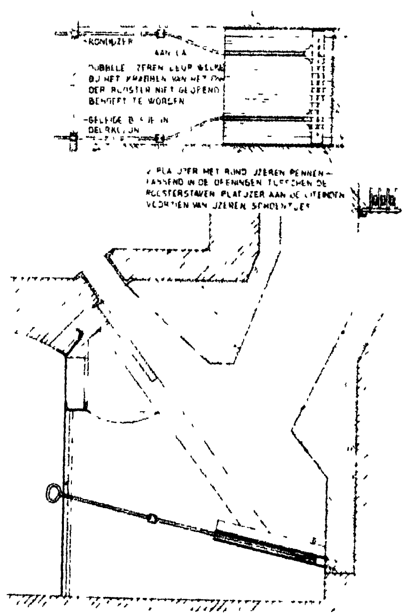
pressure gases in the chamber along the underside of the perforated deck-plate d^1. The hot flue gases may be taken from the chimney of the boiler furnaces or any other available hot gases may be used, whilst the conveyor is driven by a chain *m* from the last roll *n* of the crushing mill or any other available source of power. An exhaust to the atmosphere is indicated at *o*. It is made relatively large to discharge the moisture-laden hot gases continuously. In this way, the dried hot bagasse is discharged by a chute *p* to any desired point from which it may be directed or shovelled into the furnace. The exhaust fan *r* is coupled to the pipe *f* for feeding flue gases to the housing *e*.

Java Technical Notes.

RAKE FOR BAGASSE FURNACES. **A. H. Ball.** *Archief*, 1929, **37**, No. 35, 798-799.

Cleaning out the ashes from the furnace using an ordinary rake requires that the doors be opened ; and as this takes place several times an hour it means hot work for the stokers. But the operation can be made less irksome by the use of a large rake, the teeth of which slide between the grate bars, as shown in the self-explanatory sketch herewith. This device enables the men to do the job with the doors closed and quickly, though of course the doors must be opened at intervals to clean out the slag. Burning of the teeth of the rake will not occur if the rake when not being used is drawn out towards the front. Advantages of this method are that the work is done more comfortably and more quickly, that the combustion of the furnace is better, and that there is less formation of slag on the grate. Anyway, the arrangement is said to have done very well at Tjandie s.f.



BOILING TESTS MADE WITH A JET CONDENSER. **G. J. Schott.** *Archief*, 1929, **37**, No. 34, 772-784.

Due to the relatively high rate of grinding at the Gondang-Lipoero s. f., the vacuum of the central condensation system was not as high as was desired, the boiling of the molasses strikes particularly suffering in consequence. Seeing that an improvement by increasing the size of the installation would have been costly, it was preferred to provide a separate condensation apparatus for one only of the pans, in this case that used for the boiling of the molasses strikes. A Schutte-Körting multiple jet condenser was installed. Advantages of this apparatus are that no dry air pump is required, and injection water can be sent to several of these condensers using the same pump. Besides, the regulation of the vacuum becomes almost automatic,

and further these jet condensers are moderate in initial and maintenance costs. On the other hand, it is pointed out that a rather large amount of water is required for injection ; but then if the supply of the water is found insufficient, that from the jet condensers of the vacuum pans might be used for the central condenser installation of the evaporators. In tests undertaken to see what kind of result could be obtained, a pan having a content of 340 hl. (7480 gallons), filled with 50 hl. (1100 gallons) of cold water, was evacuated to 60 cm. in 15 mins. In another test a vacuum of 73 cm. was reached in the same time, with the water at 25°C., which vacuum is 99·6 per cent. of the theoretical. This was using 0·053 cub. m. of injection water per second. On boiling up water alone, the following are some of the results obtained in five tests :—

Test.	1	2	3	4	5
Injection water pressure	0·3 at over-pressure	10 cm. kg. vacuum	0·35 at over-pressure	0·60 at over-pressure	0·75 at over-pressure
Vacuum on the steam line, cm. Kg.	65·80	65·4	72·0	65·2	71·4
Heating by	DB+2S	DB+2S	DB	DB+2S	DB
Temperature injection water °C.	29·0	29·35	24·03	28·78	29·76
Temperature waste water, °C.	39·97	40·93	26·99	41·52	31·78
Temperature steam, °C.	51·0	52·25	33·87	52·33	—
Waste water used in cub. m./min.	3180	2586	3172	2408	2370
Weight of condensed water, kg.	2656	2147	781	2314	241
Steam in kg. per hour	3424	2799	969	3026	472
Duration of test in min.	45	45	45	45	30

In actual working conditions, that is in making a molasses strike, it was found that 14 mins. after opening the water-valve one could begin to draw in syrup ; after 50 mins. the pan was grained, and the strike was finished altogether in about 9½ hours. During the previous crop working on the central installation, 11 to 12 hours had been the average duration of the same kind of strike.

GRINDING AND STOKING QUALITIES OF POJ 2878. **G. J. Schott.** *Arch. v. d. Java Suikerind.*, 1929, 738-750, *Korte Mededeelingen*, 1929, No. 23.

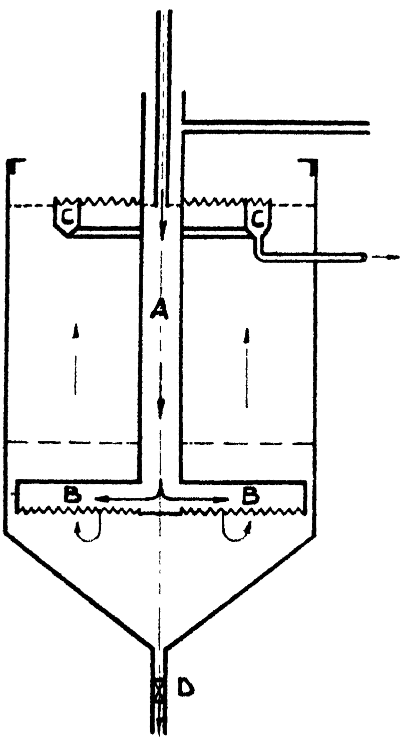
At the end of the 1928 season a questionnaire was sent round the factories to elicit opinion on the qualities of the famous POJ 2878 now largely being ground in that country, and 141 letters were received in reply. Most of the factories (123) stated that they had been able to grind well up to capacity, though some of them remarked that the softer canes were easier. On the other hand, there were others (18) who stated that, due to the hardness of the new cane, they had found difficulty in maintaining capacity. Preparation of the cane by crusher or 1st mill with crusher top roll was stated by most replying to have suffered. Most also stated that the power consumption had gone up, estimates in comparison with previous years, varying from 5 to 25 per cent., being stated. On the whole breakages had been more, the totals for 1926, 1927 and 1928 being 152, 222, and 331, those for top rollers being 86, 124 and 160, and for other rollers, 22, 39 and 50. A number of the factories were able to detect a greater wear-and-tear of mill rollers and other parts. Regarding the quality of the bagasse, a good proportion of the factories (67) judged it to be better than that of DI 52 and EK 28 ; on the other hand some (17) thought it to be coarser. In general, the conclusion drawn by the author[1] representing the Experiment Station is that the grinding of POJ 2878 does

*DB is double bottom ; and S, serpentines.
[1] Engineer of the Technical Department, Experiment Station.

make greater demands on the mills. Especially must attention be directed to the sharpening of crusher rolls and crusher top rolls; to the strong construction of the feed shoot, to the proper adjustment of the trash turner; and to good scrapers. Altogether one may be certain, it was stated, of reckoning on higher maintenance charges and the more frequent renewal of parts undergoing wear and tear. As to the bagasse, its quality is very good, but its quantity is less than 1927. Data for the fibre content indicated that it is only slightly inferior to the last cultivated varieties. Thus, in six factories grinding only POJ 2878 it was found to vary from 11·6 to 13·6 per cent., and an average of many determinations made by the extraction method on samples of 25 kg. was 12·05 per cent.

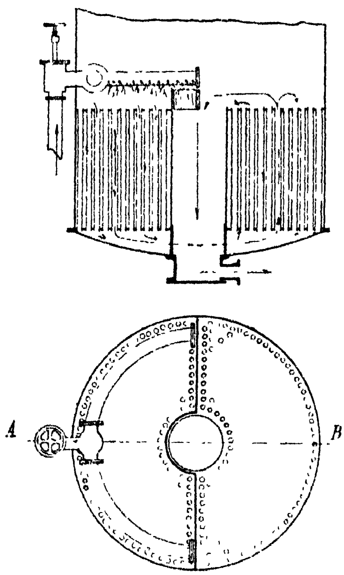
CONTINUOUS SETTLING APPARATUS. **Chr. H. Nielsen.** *Archief, Verslagen,* 1929, Afl., No. 5, 216-222.

During last crop a small experimental apparatus for the continuous settling of muddy juice was put into operation at Sroenio, Djatiroto, and Goenoengsari factories, and results were obtained such as to justify the continuance of the tests with a larger apparatus. It is seen that the apparatus consists of a cylindrical vat having a conical bottom. It is provided with a central inlet pipe *A* at the end of which are six radial distributing gutters having notched edges. In the upper part of the tank is placed a circular outlet gutter *C*, which also has notched sides. In starting up the apparatus, the cock of the muddy juice outlet, *D*, is kept closed until the level of the mud shown (lower dotted line) is reached, after which it is so set that the level is maintained as closely as possible. The outlet is so regulated that the rate at which the juice rises is lower than that at which the mud sinks, which can be easily judged by observation through the sight-glasses. It is thus seen that with this apparatus a kind of filtration takes place of the juice through the mud, and the following are the advantages that would be expected: (1) Saving of heat; (2) more concentrated juice; and (3) a clearer juice. Actually the first and third were realized in the tests, but the apparatus was too small (it held 700 litres) to prove the second point. Its capacity was about 1 cub. metre of juice per hour per sq. metre of surface, the settler at Djatiroto having a content of about 36 sq. metres and a surface of 8·5 sq. metres. At Goenoengsari the purpose of the tests was to establish if 1st carbonatation muddy juice could be concentrated in this way. Applied to defecated juices, the apparatus had given no trouble in the separation of the mud.



Beet Factory Technical Notes.

Improving Evaporation.—In the beet sugar factory at Dolní Cetno, Czecho-Slovakia, there is a quadruple consisting of ordinary vertical bodies, each of them having a central circulation tube, excepting the first, which is a Kestner. In order to increase the capacity of the apparatus, also to obtain a rapid replacement of the juice in the tubes, and further properly to utilize the total evaporating surface, the engineer of the factory, FR. PAULIK,[1] installed in the bottom of each body a dividing plate, 250 mm. (10 in.) high, the body being divided in this way into two equal parts (as can be seen in the drawing herewith). Moreover, in the space in the lower part of each body a pipe was inserted, this reaching right to the bottom, so as to close off connexion with the central circulation tube. Thus two paths for the juice were made, a third being through the circulation tube where the juice was collected. Juice entering the first body from the Kestner passed through the regulating vessel and the inlet valve into the semi-circular perforated tube, the total area of the holes of which corresponded approximately to one and a half times the diam. of the inlet valve, 130 mm. (5⅛ in.). Through these holes the juice was sprayed over the top half of the first path in full boiling, went down through the tubes, reversed, rose up the second path over into the central circulation tube, all the time boiling intensely. Then out of the bottom into the next body. Third, fourth, and fifth bodies were equipped in the same way as the second. Boiling in each body was very violent, but no frothing occurred, and the juice was rapidly evaporated. Daily 9670 quintals (967 metric tons) of beets were worked, the juice being boiled to 70-73° Balling, and with a considerable economy of coal.



Preventing Colour.—During this season in Czecho-slovakia there has been a marked fall of alkalinity during evaporation, which has made difficult if not impossible a good sulphuring of the clarified juice. But on the ground of previous experiments, which he has now continued, VL. STANEK, of the Sugar Experiment Station, Prague,[2] is able to recommend the addition of sodium sulphite to the carbonatated juice previous to evaporation, instead of sulphuring. This has been found to have an excellent effect in hindering the formation of colour during evaporation without making the juice more acid. A laboratory experiment demonstrated this: Carbonatated juice from different factories was boiled down without employing vacuum to about one-quarter of its original weight, on the one hand without any addition, and on the other hand with the addition of only 0·01 per cent. of sodium sulphite (calculated on the roots). On diluting to its original density, and determining the colour with SANDERA's objective photometer, it was seen that whereas without the addition the colour increase of the juice was about 27 to 37 per cent., with sodium sulphite the increase of colour was only 5-6 per cent. In fact in one instance the liquid which had been evaporated was

[1] *Zeitsch. Zuckerind. Czecho-Slov.*, 1929, **54**, No. 15, 151-152.
[2] *Zeitsch. Zuckerind. Czecho-Slov.*, 1929, **54**, No. 11, 114-115.

lighter than in its original condition. In practice, in the case of a factory slicing 10,000 quintals (1000 metric tons) in 24 hours one would dissolve 200 kg. of crystallized sodium sulphite in hot juice in a suitable tank with a small outlet cock, dilute to 10 hl. (220 gallons), and well mix, thus giving a 20 per cent. solution. Of this solution 41·6 litres (about 9 gallons) are run in per hour, the cock of the tank being so set as to pass 700 c.c. (1·2 pints) per minute. As sodium sulphite does not affect the alkalinity, it will be necessary in the case of a marked fall of alkalinity to treat the juice with soda. This is best done by adding it in a constant stream before the first carbonatation.

Natural Alkalinity.—As to the extent of the natural alkalinity in normal and abnormal beets little so far is known; but some experiments recently made by O. SPENGLER and C. BRENDEL[1] show the importance of observing this factor. Three series of tests were made, viz., with (*a*) roots which had been cultivated under dry weather conditions, and had further during transport undergone a slight drying; (*b*) roots which before lifting had had plenty of rain, and had been examined immediately after harvesting; and (*c*) roots which were rotted. In each series the theoretical natural alkalinity and the practical natural alkalinity were determined, and the residual lime was also recorded in the tabulated results. It was observed in the case of the (*a*) series that the t.n.a. varied greatly, namely from 0·004 to 0·026, whereas the p.n.a. remained fairly constant at 0·024 to 0·030. Since the residual lime content represents the difference between the theoretical and the practical natural alkalinities, this figure was also rather erratic, viz., from 0·003 to 0·017. In the series (*b*), however, the results were of a different order: the t.n.a. and the p.n.a. being both about the same throughout, viz., about 0·026 to 0·038, so as to leave practically no residual lime content at all, at least less than 0·002, a satisfactory condition of things. As to series (*c*) dealing with the rotten roots, the characteristics shown in series (*a*) were here reproduced to a magnified degree, the t.n.a. often falling to a negative figure, and the p.n.a. not much decreased, the result being a very high residual lime content figure, such as the authors have always found with rotten roots. These experiments show, firstly, that freshly harvested roots which have not been allowed to dry up give juices which with a proper final carbonatation to the optimum alkalinity can be almost entirely de-limed, even without addition of soda. Secondly, they indicate the importance of a suitable treatment of the roots just after harvesting so as to prevent them drying up. By leaving the roots to dry up on the field an error is committed which can only be made good in the factory at great cost. Apart from the harmful nature of the lime salts as such, they act as a measure of the colloids. The greater the quantity of lime salts, the greater that of the colloids, the harmfulness of which in the process of manufacture can hardly be doubted.

Beet Juice Clarification.—Dr. O. SPENGLER, Director of the Sugar Institute of Berlin, at one of the meetings of the Society of German Sugar Manufacturers mentioned some useful facts about beet carbonatation. At present the dose of lime varies from 1 to 3 per cent. of the roots, and 1·5 in the first and 0·5 in the second carbonatation is a very usual amount. About 10 minutes seems the average duration of liming, but it should be longer if a smell of ammonia is very evident, otherwise the acid-amides will be left to decompose during evaporation, this possibly finally leading to acid juices. The first carbonatation was formerly stopped at 0·15; but, since the nature of the roots has changed somewhat, it is necessary to carry it to 0·06 to 0·04. One may use

[1] *Zeitsch. Ver. deut. Zuckerind*, 1929, **79**, 767-770.

titrated papers indicating with precision the *pH* of the juice under treatment. After this first carbonatation, the juice should be filtered with great care, especially in making white sugar. If the juice from the filter-presses is cloudy, it should be re-filtered, as cloudiness is to be avoided at all costs. If cloudy juice goes to the second carbonatation, then the colloidal matters re-dissolve in it, and they remain there. After the first carbonatation, it is necessary to re-heat to 98°C. In operating the second carbonatation, the WEISBERG modification in which the juice is sulphited, treated with 0·4 to 0·5 per cent. of lime, and finally carbonatated, is recommended by the Institute. Juices which are very limpid, very low in lime salts, and always give good sugars, are thus obtained. After carbonatation, one re-heats to 98-100°C. Boiling-up after this is to be recommended, as it effects decompositions that otherwise would occur in the evaporators, and in this way diminishes scale formation.

Evaporation under Pressure.—Discussions have been going on in the Continental sugar papers as to when the factory in evaporation under pressure was first operated. The Hallesche Maschinenfabrik und Eisengiesserei has stated that in 1903 their engineer, P. MEYER, now Professor at Delft, obtained a patent[1] the claim of which read as follows: "A system of evaporation, principally for the concentration of the weak juices of sugar factories consisting of several successive evaporator bodies without any injection condenser and without any air pump, in which the liquid is in ebullition under a pressure higher than that of the atmosphere, the first body being heated with exhaust vapour from the engines at suitable pressure." Efforts were made at that time to interest the sugar industry generally in this method, but without success, and the patent was abandoned. In 1913-14, however, the Halle iron-works in collaboration with Dr. BUTTNER was able to install at the Polnisch-Neukirch sugar factory, in Germany, a triple effect evaporator working under pressure, and this is claimed to be the first plant to operate in this way in a sugar-house. On the other hand, a writer in a Belgian paper[2] points out that the distinction under discussion cannot be claimed by the German people since they have overlooked the fact that as far back as 1905 KESTNER pointed out that he had been working his evaporator under pressure during three years past in different industries, including that of sugar.[3] There is no doubt that the KESTNER apparatus was in continuous operation at the Tirlemont Refinery, Belgium, in 1910.

A WORLD AGRICULTURAL CENSUS.—The International Institute of Agriculture at Rome is carrying out a census of world agriculture with the cordial collaboration of the Governments concerned. When the task is finally completed, the results of the census will not only give the figures of the World agricultural inventory, but will be accompanied by a methodological documentation that will be of the greatest value in the organization of future censuses.

HIGH ALCOHOL YIELDS.—A yield of 16 per cent. of alcohol is considered normal in the fermentation of fruit juices under good conditions. But John R. Eoff and collaborators[4] describe a series of tests in which 1 part of crushed fresh pineapple and 2·5 parts of sugar solution at 35° Brix were inoculated with Tokay yeast, allowed to stand at room temperature for 24 hours, after which the juice was pressed off, placed in jugs and kept for 44 days at 15°C. At the end of that time the alcohol content was as high as 19·1 per cent. by volume. It is probable that other factors than yeast, temperature, and sugar concentration are concerned, possibly something in the fresh fruit having a stimulating effect on fermentation.

[1] No. 146, 090. [2] *Sucrerie Belge*, 1929, **49**, No. 6.
[3] At the Chemical Congress, Liege, July, 1905.
[4] *Ind. & Eng. Chem.*, 1929, **21**, No. 12, 1277-1279.

Refractories for Boiler Settings.[1]

By GEORGE W. CONNON.

The new types of furnaces that have been installed in sugar factories during the last few years have developed combustion temperatures very much higher than could be obtained with the old type of standard furnace that has been in general use for a great many years. Temperatures obtained in the old furnaces very rarely exceeded 1800°F., the average being usually 1500 to 1600°F., while most of the new furnaces are giving temperatures of 2200 to 2300°F., and temperatures over 2400°F. have been recorded.

The higher temperatures now being developed in bagasse-burning furnaces are approaching those being obtained in coal and fuel oil furnaces operating at about the same boiler ratings. If furnaces are to be installed to develop high temperatures, the refractory will have to be selected with much greater care than formerly if a reasonable length of life is to be expected from the setting, and expensive repairs are to be avoided during or at the end of the grinding season. "Refractory" here refers to fire-brick, fire clay and cements that are used for making the mortar required for laying the brick, the selection of the material for the mortar being just as important as the selection of the brick.

Brick which has a fusion temperature of at least 3200°F. can now be obtained at a reasonable cost, which is well above the maximum temperature of the furnace gases. It is not the temperature alone that causes failure of the brick, however, but the chemical interaction of the slag, and ash forming chemical combinations with the hot brick, which lowers its fusing value. It is more important that the clay from which the brick is made is suitable for the conditions under which it will operate. Potash, which is always present in bagasse, volatilizes when the bagasse burns and mixes with the furnace gases. It tends to unite with the silica in the brick to form a slag on the surface of the brick, which may cause the surface to break off or cause spalling. Hence, bricks having a large percentage of silica are not suitable for lining the walls of bagasse furnaces. The bricks used should have at least 42 to 45 per cent. of alumina, and this should be in a stable form with no free quartz present. The brick should also be low in fluxing impurities, such as iron oxide, lime, magnesia, potash, titania, etc., as these impurities tend to lower the fusion temperature and reduce the compressive strength of the brick at high temperatures. Bricks known as high alumina bricks, having over 57 per cent. alumina and a fusion temperature of 3400°F., can be obtained, but such bricks are quite high in price.

In constructing settings sufficient care is not always given in properly laying the brick. The brick should be as nearly uniform in size as can be obtained, with straight, flat faces, sharp corners, and a minimum of warpage; and the joints between the bricks should be as thin as it is possible to make them. If the joints are thick, there is danger of the mortar falling out, exposing five sides of the brick to the action of furnace gases and slag, which in time may cause the disruption of the brick. The mortar used should be mixed with water to the consistency of cream, each brick being dipped in the mortar and then pushed and rubbed into place and tapped with a mallet until it touches the brick below it.

Raw fire clay acts only as a filler; it has no bonding strength, as it does not vitrify with heat, and it has a high shrinkage. It may also melt and flow out of the joint, or crumble and fall out where the joint is thick, in either case exposing five faces of the brick to attack from slag. This will cause poorly

[1] Abridged from *Reports of the Association of Hawaiian Sugar Technologists*, 1929.

constructed walls to become weaker. High temperature cements—cold setting and heat setting—are now being used quite commonly in place of fire clay.

What is considered the best practice to-day in power plant work is to construct the walls of boiler settings entirely of fire-brick, second grade brick taking the place of red brick for the outer part of the wall. This gives a more uniform wall, which should be free from voids and have a more uniform temperature gradient. The second grade brick should have practically the same thermal expansion coefficient as the brick used on the fire-side of the wall, for if the brick on the outside is not substantially the same, as is the case when red brick is used for the outer-part of the wall, there is likely to be sufficient difference in expansion between the two halves of the wall to cause the bonding brick to shear, followed by the destruction of the wall, or at least the production of large, unsightly cracks in it.

The walls expand when they are heated, the expansion being about ¼ in. in 8 ft. of length. Expansion joints should be provided about this distance apart in all large furnaces to permit the wall to expand freely. If no allowance is made for expansion, the walls may buckle, causing destruction of the wall, or production of cracks in it. Centre or cross walls, such as the bridge wall, should not be built in or made integral with the side walls. A space should be provided at each end to allow for expansion. No red brick should be used in the bridge wall, which should be constructed entirely of fire brick, as there is danger of the red brick melting and causing failure of the wall. Red brick should be used only in parts of the setting well protected from high temperatures.

The spalling of brick may result from a number of causes, the principal one being rapid temperature changes, or it may result from the mechanical pinching of the hot ends of brick, due to the greater expansion on the side that is in contact with the furnace gases. The slag that forms on the surface of the brick will sometimes penetrate sufficiently far into the brick to make it brittle and easy to break. A brick of hard, dense texture is more liable to spall than one that is porous. This rule, however, does not always hold good, as any brick in which the mixture of clay is not uniform is likely to spall.

Cutting of brick to make them fit into the setting should be avoided if possible, as it is difficult to obtain a smooth, straight face in this way. Cutting can very often be avoided by the use of split brick, small brick, soaps, etc., all of which are now standard and can be obtained from almost any manufacturer. A setting should be designed, if possible, to avoid the use of special shapes, as these usually have to be made by hand, and the finished product is likely to be inferior and not as uniform as that made by machine. When special shapes are required, the maximum thickness should not exceed 5 in., as it is difficult to obtain a satisfactory product of greater thickness. Oversize sections usually do not stand up as well as the standard thicknesses, and special shapes always cost considerably more, per unit of weight, than do the standard shapes.

Fire bricks should not be stored out of doors, exposed to the weather, as exposure causes them to deteriorate. They should be piled on edge, that is, on the 2½ in. × 9 in. face.

Caterpillar Tractor Prices.—Price reductions on the products of the Caterpillar Tractor Company have recently been announced. As an instance the "Sixty" Caterpillar, which sold around $6000 in 1925, is now listed at $4175, a reduction of $125 off the previous current price.

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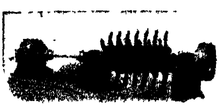

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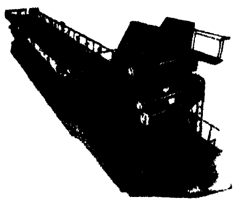
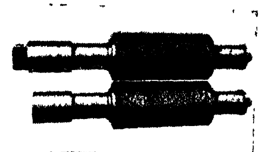


18 ROLLER DREADNAUGHT 36 in × 84 in MILL AND CRUSHER



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Publications Received.

The Application of Science to Crop Production. A. Howard and G. L. C. Howard. (Oxford University Press), 1929. Price : 9s. net.

The particular application referred to is the foundation of the Institute of Plant Industry at Indore, in Central India. Its history is briefly recapitulated, including the sources of revenue and the way in which this has been utilized, together with the aims held in view. Then follow the selection of site, the lay out of the experimental area, the sinking of wells, erection of appropriate laboratory and farm buildings, and the location of quarters for the farm labour in a model village. Each of these sections is treated with equal seriousness, as it were, by this committee of two. And during the study a thorough analysis is made of the natural conditions and status of the local agriculture, with suggestions as to the way in which it may be improved. This is undoubtedly the most valuable part of the book. Cotton is the chief crop to be studied and an account is given of the character of the work proposed ; but the necessity of rotation of crops is accepted from the start and this widens the field of study. Then the necessity of providing substitute crops for opium on the well-irrigated areas, now that it is no longer grown, is briefly considered, and wheat and sugar cane come into the picture. Sugar cane cultivation is very backward in this part of India, and the authors have made a preliminary experiment of adopting the "Java method," although no details are given. The result of this experiment was eminently successful, in that S 48 produced "35 tons of cane to the acre from which samples of gur of excellent quality have been made."

Indicators. Dr. I. M. Kolthoff, translated by N. Howell Furman, Ph.D. (Chapman & Hall, Ltd., London). Price : 17s. 6d.

Those interested in the subject of the colorimetric estimation of the hydrogen-ion concentration will be acquainted with the excellent treatise of W. MANSFIELD CLARK, and it may be also with the recently published work of Dr. BRITTON. They probably are less familiar with Dr. KOLTHOFF'S useful treatise, an English translation of which issued in 1926 is now before us. His book can be described as an original and practical manual for those using the various indicators in titrations or colorimetric hydrogen-ion concentration determinations. After two theoretical chapters, on "Neutralizations" and "Amphoteric Compounds," the author discusses : "The Colour Change of Indicators" ; "The Use of Indicators in Quantitative Neutralizations" ; "The Colorimetric Determination of Hydrogen-ion Concentration" ; and "Practical Applications of the Colorimetric Determination of H.I.C." One of the final chapters deals with "Indicator Papers," in which the sugar factory chemist shows interest by reason of the simplification offered compared with present working. We are told, however, that "the sensitivity of these papers is influenced by so many factors that it is not in general possible to use them in determining H.I.C. exactly." One factor, as shown by the author's own experiments, is that buffer solutions of about the same buffering power as that of the unknown solution should always be used for comparison purposes. Further, the indicators generally used in sugar work do not appear to be sufficiently sensitive for use in this way.

Technical Chemists' Handbook. George Lunge, Ph.D. ; third edition, revised by Alex. C. Cumming, D.Sc., F.I.C. (Gurney and Jackson, London). 1929. Price : 12s. 6d. nett.

"LUNGE" is an indispensable aid in the laboratory of the heavy chemical works ; but this small book with so much useful data in it deserves to be better known to the sugar factory and refinery chemist. It will give him the best of information on the examination of some of the materials used in his manufacture, as lime and limestone sulphur, hydrochloric acid, soda ash, caustic soda, potash salts, as used for fertilizers, and water for boiler supply. Further, under the heading of "Fuel and Furnaces," he will find details for the examination of fuel, including its calorific value, for the analysis of chimney gases, and for determining the draught and temperature. Methods are described with great care, the aim of the "Handbook" being to effect

by the adoption of standard procedure the task of establishing uniformity among chemists representing buyers and sellers. This revision has involved only minor alterations, there being no change in the general scheme which in the past has been so well appreciated. Its high reputation will without doubt be maintained in its new edition.

Phosphoric Acid, Phosphates, and Phosphatic Fertilizers. Wm. H. Waggaman and Henry W. Easterwood. American Chemical Society, Monograph Series. The Chemical Catalog Co., Inc., New York.) 1927. $7·00.

This book by two well-known American experts deals with the production and uses of phosphoric acid in general, the rôle of this chemical fertilizer in agriculture being discussed only briefly. In particular it treats of phosphate deposits in different parts of the world; so-called available phosphates: water-soluble phosphates; the manufacture of phosphates by the sulphuric acid process; the volatilization process of producing phosphoric acid; the various uses of phosphoric acid and phosphates; and lastly gives patents on the production of phosphoric acid in its different forms. Good accounts are given of the use of phosphoric acid compounds as defecating agents in sugar manufacture and refining and of animal charcoal. It forms a reliable survey of the subject within the scope indicated.

Modern Methods of Cocoa and Chocolate Manufacture. By H. W. Bywaters, D.Sc., A.R.C.Sc., F.I.C. (J. & A. Churchill, London). 1930. Price: 21s. nett.

This addition to the several books which have been published on the subject gives what the author describes in his preface as "a plain unvarnished account" of modern methods of producting cacao and of manufacturing chocolate from it. It consists in clear untechnical language of information drawn from the author's long experience of this branch of industry. Illustrations are given of the many types of machinery used, the working of which is described in a simple way. Altogether the book forms an easily read account of the subject, and it is eminently suitable for the tyro. Sugar for mixing with the cacao mass should be in as fine and uniform a state of sub-division as possible. It is to be noticed that the "Kek" machine, well-known in other industries, is found to give satisfactory results for the preparation of this icing sugar. Another which has found much favour is the WOODBURN disintegrator, which can also be used with an air separator for obtaining a uniformly fine product.

Atlas for the Sugar Industry of Europe. Prepared by F. W. Schallehn. (Schallehn & Wollbruck, Magdeburg, Germany). Price RM. 32.

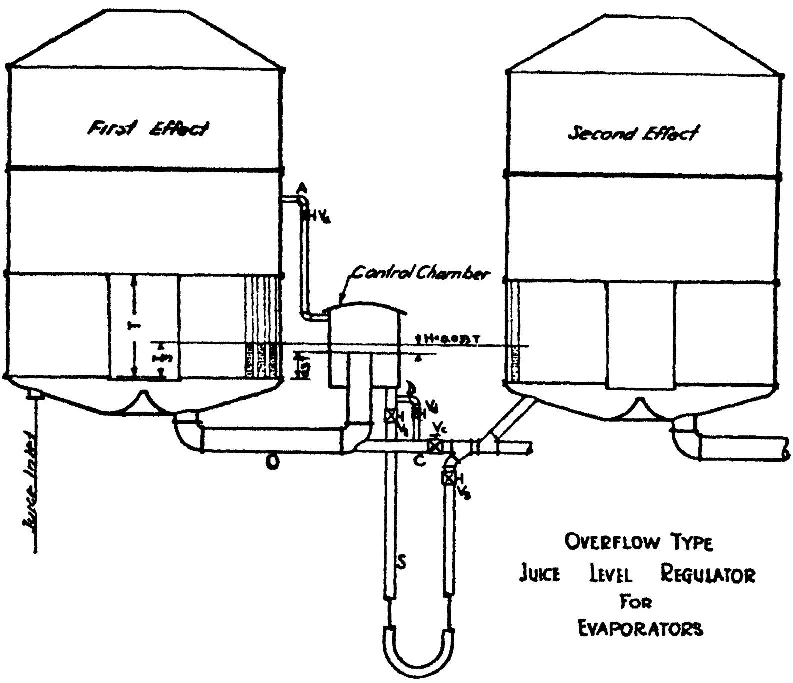
This is a coloured Atlas showing clearly the exact position of the different sugar factories and refineries of Europe, arranged in countries. Distinction is made by suitable markings between factories that work up beets, and refineries refining only raw sugar, but not between raw and white sugar factories since these last vary their precise working so frequently. Before each map there is a page giving an exact alphabetical list of the sugar factories and refineries depicted. This Atlas, consisting as it does of 71 Plates, will accordingly supply a want, in that within its pages there are collected a series of maps which if they have at all previously appeared have been isolated and published at differing times.

Manual of Sugar Companies, 1929. (Farr & Co., 90, Wall Street, New York). *Free.*

This is the 10th annual edition of a manual of sugar companies issued by a well-known firm of brokers in New York. It reviews 25 leading Cuban, Porto Rican and American sugar companies and gives synopses of some 80 other companies operating in the United States, Cuba, Porto Rico, Hawaii, the Philippines, Santo Domingo, Central America, Java, etc. Copies of this manual can be obtained without charge on request to Messrs. Farr & Co.

Review of Current Technical Literature.[1]

OVERFLOW TYPE OF THE LEVEL INDICATOR FOR EVAPORATORS. G. H. W. Barnhart. *Reports of the Association of Hawaiian Sugar Technologists*, 1929, 97-104.
This juice level indicator is dependent on a difference in head between the level of juice in the evaporator and that of the juice going over the overflow crest, this difference in head being required to overcome entrance and velocity losses, friction losses in connecting piping, and the head on the weir crest. Regulators acting on this principle were incorporated in three quadruple effect installations in 1920, in Hawaii, but the results were disappointing, these devices failing to maintain the juice level continually at the desired point, particularly when the grinding rate varied. This fault was found to be due : (1) to the original setting of the overflow chamber being too high, preventing the proper juice level being maintained when grinding at or near the maximum grinding rate ; and (2) to larger overflows and connecting piping being necessary. Referring to the sketch, the overflow and the line connecting it to the cell are made large enough so that the total of entrance and velocity, friction and weir losses H for the maximum grinding rate are equal to, or less than, 0·033 of

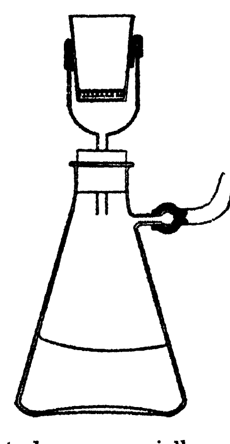


the height of tube T. The crest of the overflow is set this distance, also, below the point of desired juice level. It will be noted that the overflow is fixed. The syphon S with both valves Vs open enables the juice overflowing into the control chamber to go to the succeeding effect, being actuated by the difference in pressure between the chamber and effect, and is also of sufficient length L to act as a hydrostatic seal, preventing the drawing of vapour from the chamber and preceding cell during normal operation. The longest seal will ordinarily be between the third and fourth cells. With 26 in. Hg. in the last, and, say, 12 in. in the third, the difference being 14 in. Hg., equal to a head of 16 ft. of water, or slightly more than 14 ft. of 30°Brix juice, the bottom of the syphon should extend somewhat more than 14 ft. below the level of juice in the fourth cell. Several factors, however, affect this situation. For satisfactory operation, the size of syphon should be such that not more than about one-third of the available head is absorbed by pipe friction. Furthermore, for satisfactory operation the length should be about 25 per cent. greater than the theoretical derived from the calculation indicated above. A cut-over line C

[1] This Review is copyright, and no part of it may be reproduced without permission.—Editors, *I.S.J.*

When the sugar has been sufficiently dried, the operator applies the brake, shutting off the current by the same motion. By applying the brake, a loaded machine running at 1200 r.p.m. will come to rest in 32 seconds. The usual practice, however, is for one man to handle two machines, and the operator, when desiring to bring a loaded machine to rest, will move the handle into the neutral position and wait a few seconds before applying the brake. In this case, the time that elapses before the motor comes to rest is about 55 seconds. The machine is then unloaded and is ready for the next cycle. The cycle on an "A" strike is approximately 4 minutes. The cycle on a "B" strike is approximately 4½ to 5 minutes. The average weight of sugar per basket is approximately 450 lbs. *Power required* : This is 4·72 k.w.h. per ton. *Low Grade Centrifugals* : In addition to the above machines, there are in operation thirty-five 40 in. × 24 in. and three 40 in. × 20 in. machines, a total of 38 centrifugals for low grade sugars. Four are equipped with ball-bearing heads at the present time, and ten others will be so equipped for the coming crop. Power is supplied by a 3-stage centrifugal pump with a capacity of 2000 g.p.m., operating at a pressure of 250 lbs. and driven by a direct connected 400 h.p., 440 volt, 3-phase, 60 cycle, 1800 r.p.m. induction motor. *Remarks* : Advantages of electrical sugar centrifugals are that the sugar can be turned out faster and lower in moisture with correspondingly better keeping qualities. Experience, in general, has been that electric drive has worked out to a remarkable degree in speeding up mill production in the centrifugal department. Operating advantages are therefore : (1) Larger output ; (2) Better quality of product ; and (3) Less skill required of operators. The equipment is simple, positive, and economical in operation, and because of the few parts subject to wear, the maintenance expense is low.

SPECIAL "GOOCH" FILTER FIBRE. *Communicated by Newitt & Son, Ltd., London, W.C.1.* Chemists using Gooch crucibles (see illustration) or ALLIHN tubes for the collection of the cuprous oxide (or reduced copper), obtained in one or other method for the determination of reducing sugars, formerly had to expend not a little time and trouble in preparing the asbestos fibre. Now, however, they can buy from their laboratory dealer, under the trade name of "Powminco," a pure form of fibre, ready for use. Tests of loss on ignition and loss on digestion in hot concentrated nitric acid gave quite low figures, viz., 0·31 and 0·01 per cent. respectively. This grade of asbestos fibre should be found in every way suitable for the purpose indicated.—PRODUCTION OF ABSOLUTE ALCOHOL. **D. B. Keyes.** *Industrial and Engineering Chemistry*, 1929, **21**, No. 11, 998-1000. Production of anhydrous ethyl alcohol from 95 per cent. spirit by modern distillation methods was first accomplished in the United States on a commercial scale. Starting with YOUNG's process[1] a brief abstract with sketches of plant of the following inventions for absolute alcohol production using ternary mixtures is given : KUBIERSCHKY's[2] ; STEFFEN's[3]; RODEBUSH's[4]; KEYES'[5]; and RICARD-ALLENET's.[6] RODEBUSH's process was the original process that proved to be commercially successful in the U.S.A., where absolute alcohol has been manufactured on a commercial scale there since 1919 without interruption. Although the cost of the plant for the KEYES' process is higher than for STEFFEN's or for RODEBUSH's, the control is better, and the capacities and efficiencies somewhat higher.—AUTOMATIC VACUUM PAN CONTROL. **S. C. Mooney.** *The Sugar Press*, 1929, **13**, No. 9, 26. At the Loveland factory, Gt. Western Sugar Co., Cal., U.S.A., attempts will be made to control the amounts of water to condenser and juice to pan during boiling period by two different kinds of temperature control apparatus. One of these instruments will be placed in the pan about 2 ft. up from the top of the bottom cone, in the boiling mass. This will control the pan temperature by regu-



1 G.P., 142,502. 2 G.P., 287,897. 3 U.S.P., 1,586,717 (process), 1,586,718 (apparatus). 4 U.S.P., 1,583,314. 5 U.S.P., 1,676,735. 6 B.P., 211,454.

lating the amount of injection water to the condenser. The second control will be placed in the dome of the pan above the massecuite. This will be operated by the temperature of vapour leaving the pan, and will open and close the juice inlet valve to the pan. If, for instance, a pan should be allowed to get too heavy the flow of vapour leaving the pan would become diminished, the vacuum would increase, and the temperature of vapour would drop. The temperature control in the vapour chamber at this time would open the juice inlet valve to the pan.—REPORT OF THE ANALYTICAL SECTION OF THE JAVA E.S. *Verslag van het Proefstation*, 1928, 170-190. Two out of 21 samples of lime had much too high a MgO content; two had only 70 per cent. of CaO; and in 9 slaking was poor. Of 15 samples of sulphur, three burnt badly, due to high ash and bitumen contents. A sample of ultramarine was found to evolve sulphuretted hydrogen on boiling with water, being thus unsuitable for blueing sugar. Two samples of "Norit" were found to have too high a water-content. In 11 samples of magnesia packing, the asbestos content was much too low. In two out of nine brass tubes the iron and lead were found too high; and two only confirmed to the specification of the American Society for Testing Materials as regards structure, i.e., that the size of the crystals should be between 0·035 and 0·045 mm.; these appeared to be well annealed and internal strains were apparently absent. Filter-press cakes from different factories were found to contain too much wax, in one case as much as 15 per cent. (dry matter). Other analyses related to locally-mined kieselguhrs, to refractory materials (stone and clay, for bagasse furnaces); and to boiler and evaporator scales.—DIRECTIONS FOR ANALYSIS WORKED OUT BY THE JAVA E. S. *Ibid.*, 1928, 190-199. Glutose was determined in molasses by fermenting away the sugars and ascertaining the reducing power of the residue by SCHOORL's method. Lime was found directly in juices by precipitating as oxalate, and titrating with standard permanganate. Wax was estimated in cane, juice and bagasse by extraction with chloroform, the amounts found in POJ2878, 13 months old, being 0·171, 0·065 and 0·106 per cent. respectively. Carbonate ash was determined in sugar by mixing with oxalic acid, carbonizing in a hot-air bath, and incinerating in an electric muffle furnace, incineration over a burner being found to lead to quite large differences in the CO_2 content of the ash. Ultramarine was detected in sugar by contrifuging a 50 per cent. solution in a laboratory apparatus, when the pigment collected in a dark-blue ring above the precipitate in the point of the tube, or it was seen with a magnifying glass or under the microscope. Wax in sugars (S.H.S.) was found by extraction with chloroform in a Soxhlet apparatus, the extract being evaporated, washed three times with cold water, and dried to constant weight, three samples giving an average of 0·070 per cent. —ALCOHOL MOTOR FUEL IN THE P.I. **H. I. Shoemaker.** *Sugar News*, 1929, **10**, No. 9, 619-621. In the Philippines during 1928-29, 1·6 million gallons of motor alcohol were used, mostly "Sampson" fuel made by the Foster process, using 25 per cent. of ether. Alcohol mixed with 1-2 per cent. of gasoline is "very considerably inferior" to Sampson spirit with ordinary gasoline motors with 60-70 lbs. per sq. in. compression, even when employed with the IREY pre-heater. But the 2 per cent. gasoline mixture will probably give results as good as Sampson spirit in the high-compression motors such as are used in the internal combustion locomotives now operating in the P.I.

J. P. O.

BALL BEARINGS FOR SHAFTING.—Bearings for line-shafting were discussed by Prof. G. F. Charnock shortly before his death in a communication to the Institution of Mechanical Engineers. In dealing with ball bearings, he made allusion to some experiments carried out at Crewe Works on a length of shafting which had been fitted with ball-bearings. The shaft was driven by a 21 h.p. motor, which, with the plain bearings previously in use, was worked to its full capacity. The saving effected by the use of ball-bearings, was as follows: Current taken to start up shafting, 22 per cent. less; average current taken when running, 32·4 per cent. less; current taken to run shafting light, 30 per cent. less. The saving effected in running shafting when work was being done amounted to 4·6 h.p. out of 21 h.p., or, say 22 per cent. It is not easy, he remarked, to carry out comparative tests on an actual installation, but in practice the saving may be taken at from 15 to 35 per cent. according to conditions.

Review of Recent Patents.[1]

UNITED KINGDOM.

MILL BEARING JUICE RING AND GUARD.[2] **Alfred W. Dunn,** of Honomu, T.H. 319,950. October 13th, 1928.

As the cane is crushed between the rolls, juices and fine bagasse work into the bearings of the lower rolls and destroy the lubricating oilfilm causing metallic contact, which results in excessive wear and ultimately necessitates costly repairs. While elements known as juice rings or juice plates have been heretofore provided upon the trunnions or shafts of the crusher rolls, they have been unsatisfactory and inadequate, because as they rotated, the juices followed the peripheries of their flanges and were carried over the flanges by capillary action to enter the unprotected bearings. This invention provides a simple device whereby the cane juice and bagasse are effectually excluded from the bearings. It consists in the combination with a crushing roll journal and its bearing of a juice ring held on or engaged with the ends of the bearing and with the bearing encircling the journal.

FIG.3.

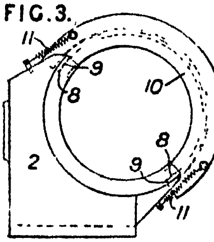
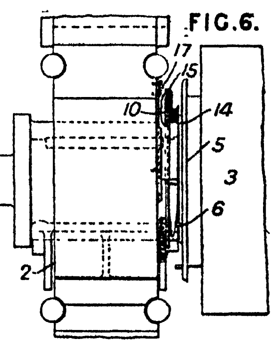


FIG.6.



Referring to the drawings, a juice ring 10 is provided which with the bearing 2 encircles the journal. The ring 10, Fig. 3, is of semi-circular shape and is maintained in position on the bearing 2 by ribs 9 engaging in recesses 8 and by springs 11 connected to the ring and bearing respectively. The inner side of the ring toward the roller 3 is recessed to receive a packing ring 14, Fig. 6, and the outer side away from the roller is provided with a flange 15 which is protected by a guard ring 17 attached to the frame. The roller 3 is provided with the usual juice ring 5 and pegs 6 are provided on the roller which sweep away any bagasse which accumulates on the juice ring 10.

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*MULCHES (OF BAGASSE) FOR CULTIVATED LAND. **T. Whittelsey,** of Ringoes, New Jersey, U.S.A. 319,783. September 27th, 1929 ; convention date, September 28th, 1928.

Mulches for cultivated ground are produced *in situ* by application of waterproofing and other ingredients in a liquid, semi-liquid, comminuted solid, or like state, or are prepared in the form of sheets or the like by combining the ingredients before application to the ground. The following ingredients may be employed, viz. : paper, rags, bagasse, straw, stalks, husks, trash, saw-dust, wood pulp, ground or semi-digested wood, oils, asphalt preparations, coal tar, rubber latex, emulsions or dispersions of rubber, waxes in solutions or emulsions, rosin emulsion, rosin soaps, aluminium soaps, paraffin, lamp black, carbon black, sodium silicate, lime, gypsum, sand, diatomaceous or other earth, hydrated cements, sulphur, and other drying, binding, vulcanizing, hardening, curing and accelerating agents. A menstruum which will evaporate may also be included, as well as preservatives, weed killers, insecticides, fungicides, and the like. An ingredient or mixture of ingredients may be sprayed, sprinkled, sifted, squirted, or blown on to the ground, or on to a layer of fibrous or other material previously applied to the ground.

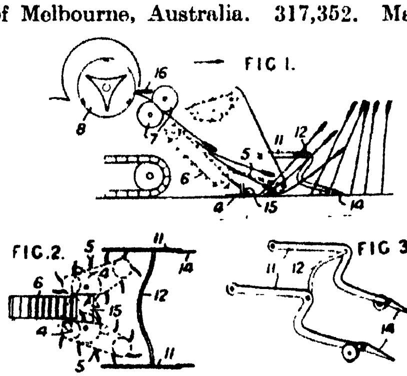
Rolls or sheets of paper or other fibrous material may be water-proofed or coated after or during application. Comminuted materials may have a preliminary treat-

[1] Copies of specifications of patents with their drawings can be obtained on application to the following—*United Kingdom* : Patent Office, Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2 (price 1s. each) Abstracts of United Kingdom patents marked in our Review with a star (*) are reproduced from the *Illustrated Official Journal (Patents)*, with the permission of the Controller of H.M. Stationery Office, London. Sometimes only the drawing or drawings are so reproduced. *United States* : Commissioner of Patents, Washington, D.C. (price 10 cents each). *France* : L'Imprimerie Nationale, 87, rue Vieille, du Temple, Paris. *Germany* : Patentamt, Berlin, Germany.

[2] See also *I.S.J.*, 1929, 625.

ment with a water-proofing or other binder or may be applied simultaneously with it, further treatment being applied after application to the ground. The mulching material may be applied in a plastic state, or in the form of foam, or may contain ingredients which will generate gases to form foam after application. By regulating the composition and thickness of the mulch, the temperature, light, moisture, and other soil conditions may be controlled. Water-proofing materials may be applied directly to prepared soil. Planting or sowing machines may be provided with means for applying the mulching materials at the same time as the seeds or seedlings. Guards may be fitted on the machine to prevent the mulch covering the ground immediately around each plant. To protect land from erosion by heavy rain, gutters may be formed which after mulching form troughs to carry off the water. Similar gutters may be formed to direct water to the plants. Cellular or more or less porous heat-insulating blankets or sheets to be used as mulches may be made of paper, bagasse, straw, etc., and water-proofed throughout or on one side only before or after application. Air may be entrapped in the material.

IMPROVEMENTS IN MACHINES FOR HARVESTING BEET. **M. Marlière,** of Cantin, Nord, France. 317,825. August 12th, 1929; convention date, August 23rd. The roots are engaged by a rotating feeler carried in a spring-pressed frame that also carries a topping knife which is thus correctly positioned for the cut. Claws projecting from the feeler remove the cut tops. The topped roots are lifted by shares and are then engaged by claws on three conveying chains which carry them to an elevator. The depth of penetration of the lifting shares is adjustable by a hand-lever. The elevator lifts the roots to the upper end of a shoot that may be adjusted so as to deliver the beets from four rows into one line.—*CANE HARVESTERS. **R. S. Falkiner,** of Melbourne, Australia. 317,352. May 14th, 1928 The harvester is provided with a forwardly projecting vertically adjustable pusher member 12 extending across the front of the machine adapted to push the cane away from the machine so that when cut by the rotating knives 4 the cane falls in such a manner that it is seized, butts first, by gathering and elevating devices. The pusher 12 is carried by arms 11 pivoted to the machine frame and provided with stump-jump fingers 14. The cut cane is directed by a guide plate 15 and gathering bands fitted with prongs 5 to an elevator 6 by which it is conveyed, butts first, to rollers 7 that feed it below a ledger plate 16 to a rotary cutter 8. This cutter, which is fitted with a deflecting plate as described in Specification 289,829, cuts the cane, tops, and trash into small pieces, the cane then being separated from the trash by devices that may include air blast means. (Specifications 104,929, 251,739, and 284,683 also are referred to; and Specification 314,364 is referred to in the Provisional Specification).—



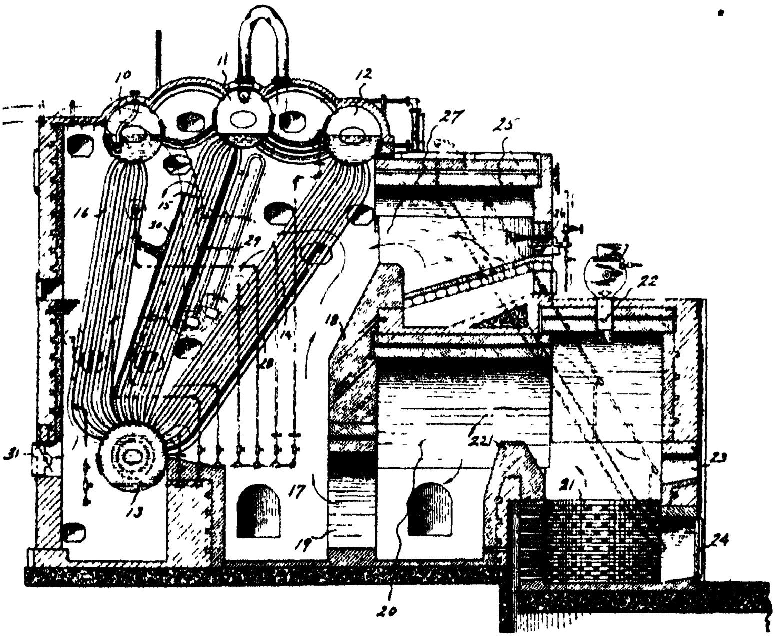
CELLULOSE SACCHARIFICATION. H. Scholler, of Munich, Germany. 315,462. **April 13th, 1928.** Cellulose, cellulose dextrines and the like or mixtures of cellulose and starch are converted into sugar by treatment under pressure with dilute acid, which is passed progressively through nearly exhausted, less exhausted and fresh raw material with removal of the sugar from the reaction chamber before decomposition thereof can occur, followed by cooling, neutralizing or reducing the pressure of the removed sugar to bring it to a stable condition. Fermented or unfermented liquor derived from the process may be used for the percolation of fresh raw material. Neutralizing substances may be added to the cellulose before the percolation, for complete or partial neutralization of the percolation liquid. The residual acid may be extracted from the liquor by water under pressure, the liquor being impregnated with metal salts and carbonized to produce active carbon. If required for alcoholic fermentation, the alcoholic concentration may be increased by an acid percolation

liquid containing alcohol, e.g., part of the fermented liquor, or fermented waste lye such as sulphite lye used in cellulose manufacture and soluble nutrient solutions for the fermentation may be added before the percolation. In some cases the concentration of sugar may be increased by subsequent acid hydrolysis. (British Specifications 160,876 and 273,317 are referred to).—CELLULOSE SACCHARIFICATION. **Soc. des Brevets Étrangers Lefranc & Cie.** (assignees of **Soc. Anon. le Vetol**, of Paris). 315,403. June 26th, 1929; convention date, July 13th, 1928. Fermentable sugars are prepared by the hydrolysis in two stages of materials containing cellulose or similar substances. Cellulose or substances which contain it in the impure state, residual cellulose from sugar manufacture, carobs, or amylaceous substances containing starch in predominant quantity or associated with cellulose materials, are charged into a pressure resisting apparatus provided with an agitator, along with a solution of sulphuric acid in water. After the temperature of the agitated mass has been raised, dry live steam is injected into the apparatus until the desired pressure has been obtained; this pressure being maintained for a predetermined time. The sugar solution obtained is discharged in a rapid manner, e.g. through an opening provided with a screen, and a further solution of sulphuric acid in water is added to the residue. As before, steam is injected, the mass allowed to remain under pressure for a predetermined time, and the further yield rapidly discharged. If sugar is present in the primary material, it may be allowed to remain or may be first extracted by any usual process. The hydrolysing substance may be hydrochloric, sulphuric, phosphoric, etc. acids, bisulphates, acid phosphates, etc.—MIXING IN DEFINITE PROPORTIONS, AND WEIGHING. **Soc. des Sucreries Ternynck**, of Chauny, Aisne, France. 316,862. April 22nd, 1929; convention date, August 3rd, 1928. Apparatus for automatically feeding liquids, solids, or solids and liquids, in definite proportions to a mixing machine comprises means for feeding the materials to tipping scale pans, means being provided for controlling from a single pan the operation of the feed to the other pans, and for stopping the feed to that pan in the event of the failure of the feed to any of the others; means are also provided for stopping the apparatus when the output vessel to which the pans discharge is filled.—FERMENTATION OF SUGAR SOLUTIONS: ACETIC AND LACTIC ACIDS. 316,287. **Distilleries des Deux Sèvres**, of Melle, France. April 5th, 1929; convention date, July 27th, 1928. Acetic and lactic acids are produced by fermenting sugar (sucrose, glucose, the pentoses, maltose and lactose) with a species of bacteria named *Lacto-bacillus acidophilus B* which ferments worts rich in sugar and exists in the natural mould of milk, being selected by acting on a culture medium containing 10 per cent. sugar and testing samples on natural sugar worts at a temperature of 38°C. and with a lactic acid content of 25 to 30 grms. per litre until the species of bacteria is found evolving rapidly in such a medium. An example is given of the fermentation of molasses or beet juice containing 30 grms. of sugar per litre, and of pentoses, the pentose wort being prepared by treating wood chips or shell husks of oats or other vegetable matter containing pentosans with a flow of water acidified with 20 grms. of sulphuric acid per litre at a temperature of 85-95°C. The extract is neutralized with lime, phosphate and nitrogen being added as nutrient substances for the development of the bacteria.—CLARIFICATION OF MOLASSES FOR FERMENTATION. **Distillers Co., Ltd.**, of Edinburgh, and **W. G. Bennett**, of Epsom, Surrey. 319,641. June 25th, 1928. Colloids, colouring matters and metallic salts are removed from molasses of any kind by treatment in the neutral or slightly acid condition with an adsorbent that does not contain free carbon and at the same time or subsequently with a protein precipitant in the presence of protein and filtration after each treatment. Any excess of protein remaining in the solution after treatment is if desired converted into a food suitable for yeast. A suitable protein precipitant is synthetic or natural tannin, and suitable adsorbents are ground nut cake when operating in two stages or calcium carbonate when operating in one. A suitable protein such as blood serum is added to the molasses if deficient in protein. The filtered nut cake can be treated in the usual way for the preparation of peptone from which iron is removed before using.

UNITED STATES.

Bagasse Furnace. **George P. Ward**, of Habana, Cuba (assignor to the **Fuller-Lehigh Company**, of Delaware, U.S.A.). 1,726,050. August 27th, 1929; application, November 28th, 1923; serial, 677,582.

One of the objects of the invention is to provide a compact arrangement in which either solid or fluid fuel may be used separately or both in combination; also to provide an arrangement in which the two fire boxes may be combined in a compact manner and so that the operation of either one will not be interfered with by the presence of the other. In the drawing herewith a furnace is connected to a Stirling boiler of a known type, with the fire boxes arranged to burn bagasse and oil, respectively. The boiler has three upper steam and water drums 10, 11 and 12 and a mud drum 13 connected by vertically inclined banks of water tubes 14, 15 and 16, the boiler being placed in a setting over a combustion chamber 17. A wall 18 replaces the usual front furnace wall for such a boiler and through it is a gas inlet 19 connecting with a combustion chamber or gas passage 20 separated from the bagasse fire box proper 21 by a bridge wall 221. The bagasse may be supplied through an opening 22 in the roof of the fire box and access openings 23 and 24 are provided through which the fire may be reached by the operator of the furnace. Above the gas passage 20 and located so as not to interfere with the bagasse feed opening 22 is a fluid fuel box or combustion chamber 25 provided with an oil burner 26 at its front



end and having a connexion through the opening 27 with the combustion chamber 17. Preferably, the front bank of tubes 14 which constitutes the rear of the combustion chamber 17 is provided with a baffle 28 extending upwardly from the mud drum 13 and terminating short of the drum 12. This baffle 28 may be located in front of the entire bank, but preferably behind one or more rows of tubes of this front bank. At the rear of the bank 14 is a baffle 29 extending downward along the tubes of the bank 15 from the drum 11 and terminating short of the drum 13. Another baffle 30 extends upward from the drum 13 towards the drum 11 at the rear of the bank 15. A gas outlet 31 is provided at the lower rear part of the setting. In operation, bagasse is charged into the fire box 21 and burned, the heated gases therefrom passing through the gas passage 20 where they are more thoroughly combined and burned, and from thence pass through the opening 19 into the lower part of the combustion chamber 17.

In the event that the supply of bagasse is insufficient, then the burner 26 may be brought into action, access to the burner being had without interfering with the bagasse supply through the opening 22. The hot gases from the oil burned in the fire box 25 will pass through the opening 27 into the upper part of the combustion chamber 17. It will be understood that, if desired, the bagasse furnace alone or the oil burner alone may be in operation. Both of these fire boxes may be located in front of the boiler, so that the gases from each of them may enter the combustion chamber thereof and pass to the boiler tubes in an efficient manner. The boiler tubes are preferably screened from the direct radiant heat of the solid fuel furnace by the wall 18 and the bridge wall 221 while the boiler tubes are directly exposed to the radiant heat of the fluid fuel furnace. Preferably, the form of baffling illustrated is used rather than the usual form, in which there would be no baffle located in front of the tubes of the bank 14. With this latter construction, the gases from the oil burner may pass over the top of such a baffle without contacting with the tubes in the first bank, so that the heat therefrom would be absorbed only by the tubes in the middle and last bank. By providing the baffle arrangement illustrated, the gases from both the bagasse and the oil follow substantially the same path and contact with all of the tubes of the boiler. This last would be completely true if the baffle 28 were placed in front of all of the tubes in the bank 14. It is preferred to place it behind one or more rows, however, so that the baffle will be protected from the direct heat of the gases from the bagasse fire box.

CLARIFICATION (CARBONATATION) PROCESS.[1] **Gerhard E. van Nes**, of Pasoeroean, Java. 1,727,738. September 10th, 1929.

A quantity of lime or other base is first added to the cold raw juice, such that the reaction towards phenolphthalein is rendered weakly alkaline. The solution is then over-saturated with carbon dioxide or with other acid gas; that is to say, carbon dioxide, or gases containing carbon dioxide or other acid gases are passed through the solution until the latter shows an acid reaction, at least towards phenolphthalein. The solution is then heated to a temperature not exceeding 60°C., preferably a temperature of 55°C., and a quantity of lime is added such that the solution shows a final alkalinity higher than that corresponding to 300 mgrms. of CaO per litre in the juice, preferably an alkalinity corresponding to about 700 mgrms. of CaO per litre when titrated, using phenolphthalein as indicator. This usually requires about 10-12 litres of milk-of-lime of 15° Baumé per 1000 litres of juice. The precipitate is allowed to settle for about half an hour. It has been found that when the above mentioned alkalinity and temperature prevail during the settling period, no decomposition of reducing sugars occurs, which might be disadvantageous for the further operations. After the precipitate has settled, the turbid juice, having a volume of about 30-35 per cent. of the total volume of the juice, is separated from the clear juice by decantation. The clear juice can be filtered easily after it has been fully carbonated, and may then be worked up in the usual manner. The turbid juice, together with the deposited matter, may be filtered and the filtrate may be added to the clear juice. As the volume of the turbid juice is relatively very large, however, the filtering operation of this juice requires an inconveniently large filtering apparatus. The turbid juice is therefore saturated with carbondioxide or other acid gas until it is again over-saturated (i.e. acid towards phenolphthalein) and is then heated to a temperature above 50°C., preferably to a temperature of 80°C., and the precipitate is allowed to settle. The deposits settle very rapidly. The turbid juice obtained (about 20 per cent.) can be filtered very easily. The juice from the filter-press is added to the clear juice from the final settling and the liquid obtained in this way is added to a subsequent batch of cold over-saturated raw juice, before the operation of heating the latter to 55°C., as previously described. It has been found that the addition of juice, which has been subjected to a preliminary treatment as described, to the over-saturated raw juice has a favourable influence on the content of lime of the purified juice finally obtained. Claim :—1. A process of purifying sugar juices, comprising the steps of treating the raw juice with lime until it shows a weakly-alkaline reaction, then saturating it with an acid gas until it shows an acid reaction,

[1] See also *I.S.J.*, 1929, 684.

heating the liquid so treated to a temperature not exceeding 60°C. preferably about 50°C., adding a further quantity of lime until the liquid shows a final alkalinity higher than that corresponding to 300 mg. CaO per litre in the juice about 700 mg. CaO per litre in the juice, and decanting the clear juice from the turbid juice. By this carbonatation process lime is economized.

IMPROVEMENTS IN WATER-TUBE BOILERS. **Percival F. Crinks** (assignor to **Vickers Boiler Co., Ltd.,** of London). 1,720,469. July 9th, 1929. A water-tube boiler, combines a main steam and water drum, a water drum comprising an outer shell and an inner shell secured within and spaced from the outer shell to define an annular water circulating chamber, said inner shell constituting a settling chamber, a stabilizing drum, tubes connecting said settling chamber with the main drum, tubes connecting said main drum with said annular chamber, a longitudinal baffle in said main drum disposed between the ends of the tubes connecting said main drum with the settling chamber and annular chamber respectively, said baffle terminating short of the ends of the main drum and having shaped ends disposed between the ends of said main drum and certain of the tubes connecting said drum to the annular chamber, tubes connecting the stabilizing drum with the main drum, tubes connecting the stabilizing drum with the annular chamber, and a longitudinal baffle in said annular chamber disposed between the ends of certain of the last mentioned tubes.—IMPROVEMENTS IN THE RECOVERY OF SUCROSE FROM CANE MOLASSES. **Holger de Fine Olivarius** (assignor to **California Packing Corporation,** of San Francisco, Cal., U.S.A.). 1,730,473. October 8th, 1929. A process of recovering sucrose from cane molasses includes fermenting the molasses to eliminate invert sugar, mixing the fermented molasses with alcohol, adding an earthy metal oxide or hydroxide to the solution to precipitate interfering organic and colouring matter without materially precipitating the sucrose, separating the precipitated organic and colouring matter from the solution, separating the alcohol from the solution, and treating the residual solution with an earthy mineral oxide or hydroxide to precipitate the sucrose.—BEET-THINNING MACHINE. **Herman H. Boettcher,** of Blue Earth, Minn., U.S.A. 1,732,830. October 22nd, 1929. A beet thinning machine comprises: Spaced endless rails disposed parallel to each other and at an angle to the line of travel of the machine, endless elements mounted for travel at opposite sides of the said rails, means for imparting motion to said elements, the said elements being arranged in planes parallel to the line of travel of the machine, rods extending between said elements, supporting members upon the rods, blades supported by said members, and means carried by the supporting members and slidably engaging the rails for effecting sliding movement of said members on said rods.—EVAPORATOR. **Wilhelm Vogelbusch,** of Ratingen, Germany. 1,733,476. October 29th, 1929. Claim is made in an apparatus for evaporation, distillation or the like, the combination of at least one chamber for the liquid to be evaporated, this chamber having at its lower part a liquid space and above this space a vapour-space for the vapour produced of the liquid, with at least one heating device arranged beside the said chamber, this heating device consisting of one or more tubes branched off from the liquid space of the said chamber, a bank of tubes communicating at their outer ends with the first named tube or tubes and with the other ends with the vapour space of the said chamber, the first named tube or tubes being of a larger diam. that the second named tubes, and a jacket consisting of two parts, one of which encloses the first named tube or tubes and the other part encloses the second named tubes, these two parts of the jacket communicating with one another only in the neighbourhood of the outer ends of the said tubes, the second named part of the jacket being provided with an outlet for the non-condensible portion of said heating agent, and an outlet for products of condensation.—BEET HARVESTER. **George A. Fontaine,** of Detroit, Mich., U.S.A. 1,733,533. October 29th, 1929. A flight for a conveyor comprises a pair of U-shaped members one of which is smaller than the other and disposed between the arms of the other member, a terminally apertured member carried by each arm of the smaller U-shaped member and receiving the corresponding arm of the larger U-shaped member of this machine for harvesting beet.

United Kingdom.

IMPORTS AND EXPORTS OF SUGAR.

IMPORTS.

Unrefined Sugars.	One Month ending December 31st. 1928. Tons.	1929. Tons.	Twelve Months ending December 31st. 1928. Tons.	1929. Tons.
Poland	18,578	300	22,765	57,205
Germany	....	....	460	33,757
Netherlands	....	....	....	....
France	....	....	....	....
Czecho-Slovakia	246	....	21,330	20,070
Java	4,013	10,364	8,106	168,854
Philippine Islands	....	....	....	....
Cuba	33,080	8,177	704,393	681,652
Dutch Guiana	....	....	....	....
Hayti and San Domingo	293	9,975	208,971	197,475
Mexico	....	....	....	....
Peru	8,267	7,762	100,299	125,805
Brazil	1,983	....	18,017	11,637
Union of South Africa	17,397	13,470	71,484	96,373
Mauritius	25,692	59,330	184,062	272,181
Australia	35,778	43,629	151,450	223,209
Straits Settlements	....	....	....	....
British West Indies, British Guiana & British Honduras	5,639	2,324	138,414	91,918
Other Countries	9,892	14,865	79,395	75,097
Total Raw Sugars	**160,861**	**170,196**	**1,709,146**	**2,055,233**
Refined Sugars.				
Poland	499	....	3,833	....
Germany	22	108	1,080	1,017
Netherlands	2,929	567	87,866	13,857
Belgium	156	76	3,762	1,138
France	....	....	....	....
Czecho-Slovakia	7,748	4,375	100,366	29,139
Java	....	....	....	....
United States of America	990	689	15,232	10,518
Canada	6	....	6,169	10
Other Countries	13	8	3,088	314
Total Refined Sugars	**12,363**	**5,822**	**221,395**	**55,993**
Molasses { Foreign	14,167	7,763	196,301	168,907
Molasses { British	1,234	2,472	22,306	53,840
Total Imports	**188,625**	**186,253**	**2,149,148**	**2,333,973**

EXPORTS.

British Refined Sugars.	Tons.	Tons.	Tons	Tons.
Denmark	99	46	1,092	1,036
Netherlands	31	30	393	350
Irish Free State	4,766	2,494	48,996	49,891
Channel Islands	52	139	1,339	1,347
Canada	....	....	....	....
Other Countries	1,653	12,485	22,946	114,033
	6,601	15,194	74,767	166,657
Foreign & Colonial Sugars.				
Refined and Candy	182	117	9,806	2,417
Unrefined	47	62	923	891
Various Mixed in Bond	....	....	....	....
Molasses	472	940	4,342	11,062
Total Exports	**7,302**	**16,313**	**89,838**	**181,027**

United States.

(Willett & Gray.)

(Tons of 2,240 lbs.)	1929. Tons		1928. Tons.
Total Receipts, Jan. 1st to December 21st	3,353,644	..	2,900,668
Deliveries „ „	3,009,065	..	2,906,188
Meltings by Refiners „ „	2,915,987	..	2,812,915
Exports of Refined „ „	84,000	..	102,132
Importers' Stocks, December 21st	442,810	..	103,020
Total Stocks, December 21st	600,612	..	181,154
	1928.		1927.
Total Consumption for twelve months	5,542,636	..	5,297,050

Cuba.

STATEMENT OF EXPORTS AND STOCKS OF SUGAR, AT NOVEMBER 30TH.

(Tons of 2,240 lbs.)	1927. Tons.		1928. Tons.		1929. Tons.
Exports	3,890,646	..	3,485,577	..	4,484,170
Stocks	344,693	..	287,347	..	254,694
	4,235,339		3,772,924	..	4,738,864
Local Consumption..	146,000	..	63,004	..	96,156
Receipts at Ports to November 30th ..	4,381,339	..	3,835,928	..	4,835,020

Habana, November 30th, 1929. J. GUMA.—L. MEJER.

United Kingdom.

STATEMENT OF IMPORTS, EXPORTS, AND CONSUMPTION OF FOREIGN SUGAR FOR TWELVE MONTHS ENDING DECEMBER 31ST, 1927, 1928, AND 1929.

IMPORTS.

	1927. Tons	1928 Tons	1929 Tons.
Refined.. ...	468,716	.. 221,395	.. 55,993
Raw	1,176,918	.. 1,709,146	.. 2,055,233
Molasses .	144,904	218,608	.. 222,717
	1,790,538	2,149,149	2,333,973

EXPORTS (Foreign).

	1927. Tons	1928 Tons	1929 Tons.
Refined .. .	3,720	.. 9,806	. 2,417
Raw	1,999	. 923	. 891
Molasses	348	4,342	11,0[illegible]
	6,067	15,071	14,370

HOME CONSUMPTION OF IMPORTED SUGAR.

	1927 Tons		1928 Tons		1929 Tons
Refined	522,311	.	219,625		51,708
*Refined (in Bond) in the United Kingdom . ..	880,040	.	335,011	.	3,338
†Raw	138,648	..	1,239,655		1,888,183
Total of Sugar	1,540,999		1,791,290		1,946 229
Molasses	6,048	..	8,061	.	9,171
Molasses, manufactured (in Bond) in United Kingdom ..	93,619	..	15,588	..	4
	1,640,666		1,817,939		1,955,404

STOCKS IN BOND IN THE CUSTOMS WAREHOUSES OR ENTERED TO BE WAREHOUSED AT DECEMBER 31ST

	1927 Tons		1928. Tons.		1929. Tons.
Manufactured from Home Grown Beet	48,350		67,600	..	101,500
Refined in Bond	68,050		12,350	..	—
Foreign Refined	24,250	.	12 100	..	9,400
„ Unrefined	121,700	.	182,300	..	278,000
	262,350		274,350		388,900

* The quantities here shown are exclusive of the deliveries of refined sugar which has been produced from duty paid sugar returned to refineries to be again refined. Sugar refineries ceased working in Bond as from 25th April, 1928

† The quantities here shown include 65,234 tons entered for refining in refineries in the month ended 31st December, 1929, and 1,732,512 tons in the twelve months ended 31st December, 1929.

United Kingdom Monthly Sugar Report.

Our last report was dated 6th December, 1929.

The market has continued to fall and prices for all sugars in every market are again lower than a month ago. In the U.K. the uncertainty as to the proposed duty changes in the next Budget has caused an uneasy feeling and holders have been anxious to lighten their stocks.

The London Raw Terminal Market has been active, but owing to the fact that in the statement by the Chancellor regarding Safeguarding duties in the House of Commons, no reference was made to the preferential duties, the market became still further depressed. March, the principal month affected, sold down to 6s. 8¼d. and May to 7s. 8¼d., both months subsequently recovering to 6s. 11¼d. and 7s. 10½d. respectively, but later fell back to their former lower level. August moved from 8s. 2¼d. to 8s. 5¼d. to 8s. 2¼d., and December from 8s. 4½d. to 8s. 6¾d. to 8s. 5¼d.

In the White section business was very idle, and transactions are few and far between. Generally speaking, the market has declined about 6d. per cwt. March sold from 10s. 6d. to 10s., May from 10s. 10½d. to 10s. 6d. and August from 11s. 5¼d. to 11s. 0¾d.

The latest prices are :—

	MARCH	MAY	AUGUST	DECEMBER
Raw	6s. 8¼d. ..	7s. 8¼d. ..	8s. 2¼d. ..	8s. 5¼d.
White	9s. 11¼d. ..	10s. 6d. ..	11s. 0¾d. ..	—

The trade has been very quiet and is still continuing its policy of buying hand to mouth. The Refiners reduced their prices 3d. on December 23rd, but advanced them again by 3d. on January 3rd, so that their prices of No. 1 Cubes at 26s. 3d. and London Granulated at 22s. 10½d. are the same as a month ago.

Home Grown sugars have moved in sympathy and to-day's prices are 21s. 9d. to 21s. 3d. according to factory. Raw sugars have been very slow and our refiners have only bought small parcels afloat or near at hand down to 8s. c.i f

Sugars bearing the preference have been disposed of at a parity of 7s. 3d. to various refiners and some Home Grown factories.

The single seller in Cuba has maintained a firm attitude but disposed of some sugars recently at $2\frac{1}{16}$ c.i.f. New York.

With regard to Europe, F. O. Licht has again increased his estimate to 8,415,000 tons against 8,467,000 tons last year. There is talk of further increases in the European sowings of the next crop owing to the lower price of cereals.

21, Mincing Lane,
London, E.C.3.
10th January, 1930.

Arthur B. Hodge,
Sugar Merchants and Brokers.

THE

INTERNATIONAL SUGAR JOURNAL.

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The Editors will be glad to consider any MSS. sent to them for insertion in this Journal, and will endeavour to return the same if unsuitable; but they cannot undertake to be responsible for them unless a stamped addressed envelope is enclosed.

No. 374. FEBRUARY, 1930. Vol. XXXII.

Notes and Comments.

The Outlook.

The sugar market has remained depressed during January, and fresh low records have been registered, prices in New York having dropped to as low as 1 3/16 c. c.i.f., while in London a May terminal transaction was effected for 88° beet f.o.b. Hamburg at 6s. 7½d. per cwt. (said to be equal to 4s. 9d. ex factory). The market for free sugar in this country continues to be hampered by fears as to changes in the coming Snowden Budget, and a hand to mouth buying policy persists; in America the surprise decision with regard to the sugar tariff (mentioned further on) has resulted in considerable quantities of stored duty-paid sugar being released. Yet viewed by the general statistical position, these prices may be judged unjustifiably low. Czarnikow points out that in the past two seasons a total increase in world production of no less than 3,350,000 tons has been nearly all absorbed, as judged by the figure for visible stocks. This explains the steady depreciation in values, but it also augurs well for the world's ability to absorb future supplies. Licht estimates that the 1929-30 world production will decrease by 3·27 per cent. or 937,000 tons, while consumption increases, if no more than in 1928-29, will amount to 3·28 per cent. This would bring consumption nearly up to the level of production, but would not decrease the existing large stocks. A good deal rests with Cuba. Rumour credits her with an intention to prohibit new plantings and to hold off the market anything up to 20 per cent. of her present crop. Be this so or not, the Single Seller continues to remain firm, and has sold new crop sugar to New York at 2 cents c.i.f. as a minimum.

The West Indian Sugar Commission and its Report.

The West Indian Sugar Commission has just returned to England from its investigations, and its uncompromising report is now in the hands of the Government. But Lord Olivier feels so strongly in the matter that he has not waited for the publication of his findings to speak on the subject but, just as we are going to press, has stated the case in a speech in the House of Lords. There he (a Labour Peer) strongly criticized Mr. Snowden for having last July declared his wish to sweep away all duties on sugar, before he had been fully apprised of the real facts of the situation. This intimation of policy which has not yet been modified has "knocked the bottom out of

the market." It is the belief of LORD OLIVIER and his colleagues that under present circumstances and without preference the West Indian sugar industry could not continue to carry on ; any withdrawal of the present fiscal assistance or of its equivalent would result in these sugar-producing colonies being entirely knocked to pieces. It is expected that the Government will publish the Report without much further delay ; and then we shall doubtless be in possession of one of the strongest series of arguments for not interfering with the operations of the sugar preference.

The Beet Sugar Subsidy.

The one or two occasions in the year when the Government have to go to the House of Commons, for authority to "supply" the funds required for carrying out their obligations under the Sugar Subsidy Act, provide the facilities for a full dress debate on the advantages of that measure in furthering the progress of establishing the beet sugar industry in England. The money already voted a year ago for the 1929 crop proved inadequate, as the acreage grown and the sugar content achieved exceeded expectations. So a supplementary sum had to be voted last month, and an interesting discussion of some four hours' duration ensued. Some of it was purely political and consisted in a good-natured argument as to whether the present Labour Government or its Conservative predecessors had the lion's share in inaugurating a measure which was admitted on all hands to have served agriculture well. More than one Conservative speaker pointed out that of late years there had been increasing hostility amongst the Labour party to this subsidizing of home grown sugar. But the debate revealed the gratifying fact that amongst the large influx of new Labour members returned at the general election last year there was a considerable number who had investigated the working of the measure for themselves and had been struck with its effectiveness, not so much in establishing the factories as capitalistic concerns, as in providing the rank and file of agriculture with a source of profit when other crops were proving more or less unremunerative. It was left to the Parliamentary Secretary to the Ministry of Agriculture to point out that the only hostile criticism offered in the debate came from the member for Greenock, who, we may observe parenthetically, has a perennial growl at these beet sugar factories, his latest grievance being that these rivals to the older refineries do not close down when their all too short slicing season is over, but endeavour to pay their way by taking in lodgers in the shape of foreign raw sugar which they refine in the inter-season. Apart from the fact that there is enough raw sugar coming into this country under present arrangements to provide work for all the refineries and beet factories, it may be pointed out that the object of the subsidy was to give these new factories time to establish themselves on a paying basis through some years of experimentation (always a costly proceeding), and if they are to solve the problem of carrying on between the beet sugar seasons, they may as well make a start at once with experiments in refining cane sugar rather than wait till the subsidy days are over.

However to return to the Commons debate. This, as we said above, reveals a changing attitude on the part of both official and unofficial Labour towards the experiment ; and it is all to the good that the Government are carrying on an investigation into the economics of the matter, in course of which they are obtaining evidence not only in this country but from beet territories abroad. The report of this investigation should be out by the

summer, and it will have some influence in deciding what chances the British beet sugar industry has of carrying on from 1934 without any aid ; if aid is indispensable, then whether the industry especially from its agricultural point of view merits its continuation or not.

It was pointed out during the debate that there is no longer any apparent incentive for capital to come forward and complete the blanks in the chain of factories with which England is now dotted. The most obvious hiatus is the south-west district of England, from Somerset to Cornwall, where, as Major DAVIES urged, the acreage is waiting but the factory is not. The hesitation to provide the latter is obviously due to the reflection that in three years more the subsidy may cease, in which case the newcomer will be at an obvious disadvantage financially as compared with its predecessors with seven to ten years of subsidy stored in their coffers. It was left to VISCOUNT WOLMER to make the pertinent suggestion that any such new factories started to fill up the gaps should be in receipt of a new subsidy of equal amount and duration with that given to the older factories. Such a scheme would naturally be open to abuse, but with proper safeguards against any invasion of supplies from "foreign" beet areas, it might well serve to solve the difficulty. The Government may rightly consider that the present 19 factories are a sufficient number to solve the experiment for which the subsidy was granted ; but from the agricultural point of view there is much to be said for rectifying the omission of south-west England from any participation in the trial.

United Kingdom Consumption of Imported Sugar, 1929.

On page 55 of our January issue we gave (but too late for analysis) the details of the consumption of imported sugar for the year 1929, compared with the two previous years. The figures of home grown sugar have yet to be published. The total of Refined, Refined in Bond, and Raws amounted to 1,946,229 tons, as compared with 1,794,291 tons in 1928, and 1,541,000 tons in 1927. The outstanding feature of 1929, as Messrs. CZARNIKOW point out, is the large increase of 180,000 tons in the imports as compared with 1928. Imports of Refined showed a decrease of 170,000 tons, while Raws increased by 350,000 tons. Java shows the most important increase with 160,000 tons more, whilst receipts of Preferential sugar are larger by 145,000 tons as compared with 1928 and by 285,000 tons as against 1927, such increases being mainly due to larger Australian and Mauritius imports. Details will be found in the Table reproduced elsewhere. Larger exports of British Refined are also an interesting feature, the increase of over 90,000 tons being shipped to India and the Far East. Official consumption figures, Messrs. CZARNIKOW add, are rather misleading, but deducting the exports of British refined manufactured from duty-paid raws, and including the withdrawals of home-grown sugar, the important increase in deliveries registered in 1928 appears to have been fully maintained during 1929.

United States Sugar Consumption during 1929.

Messrs. WILLETT & GRAY report that the consumption of sugar in the Continental United States for the calendar year 1929 was 5,810,980 long tons expressed in terms of refined sugar and is the largest figure of consumption in the history of that country. It compares with a figure during 1928 of 5,542,636 tons, thus an increase of 268,344 tons or 4·84 per cent. But this percentage is below the average increase per annum over a period of 107 years, which works out at 5·11 per cent. The per capita consumption of

1929 is 108·13 lbs., as compared with 104·27 lbs. in 1928, and the record of 109·30 lbs. in 1926. Since 1924 there has been an increase each year, except in 1927 when a decrease of 6·60 per cent. was registered; the record increase in those years was in 1925, when it was 13·50 per cent.

The important points to be noticed in the 1929 consumption are the rather sharp decrease in domestic beet sugar (the quantity consumed in 1929 totalling 856,640 tons, compared with 1,037,241 tons in 1928) and the large increase in foreign whites going into direct consumption, there being a total of 483,711 tons consumed, as compared with 342,955 tons in 1928. Quite a number of countries are included in this 483,711 tons, as the sugar came from Cuba, Porto Rico, the Philippines, Mexico, several Central American countries, Hong Kong, Java, etc. The U.S. Atlantic ports refiners do not seem to have obtained the full proportionate increase in the consumption, as that through these ports shows an increase of 2 per cent. only. According to price averages recorded by WILLETT & GRAY, the margin between the prices of raw and refined during 1929 was 1·256 cents. per lb. but for various technical reasons the margin actually achieved by the refiners was probably less than this figure.

The Senate and the Sugar Tariff.

On January 16th the U.S. Senate took a vote on the proposal put forward by Senator HARRISON of Mississippi that the present duty of 1·76 cents. per lb. on sugar should be retained instead of the figure of 2·40 cents which had been proposed by a House Committee, and to the general surprise passed it by the ample majority of 48 to 38. This was less even than the figure of 2·20 recommended by the Senate Finance Committee. The *Times* Washington correspondent states that this result was due to defections from the regular Republican ranks on the part of Senators from the eastern industrial States. These defections indicated, in part, the extent to which every action in the Senate, as in the House of Representatives, is influenced and overshadowed by considerations of the elections in the coming Autumn. Any increase in the tariff on sugar is bound from an electoral point of view to have effects on the "poor housewife's budget." Indeed, many Democrats hoped that the increased tariff would be passed, so that they might be provided with an excellent election slogan: "Your sugar costs you more." An ironical feature of the debate, adds the *Times*, was the fact that Great Britain was repeatedly held up to the Senate as a shining example of protectionism in connexion with the beet sugar industry.

The result of this decision naturally disappointed the holders of duty-paid sugars which were being held pending an expected increase in the tariff and the market weakened under their subsequent sales. But the Senate's decision does not apparently finally settle the question, and a conference between them and the Committee of the House of Representatives is the next step and may conceivably result in some further adjustment. So for the moment uncertainty continues to prevail, but it seems evident that the 64 cent increase recommended by the Lower House has no chance of being adopted.

Empire Production under Preference.

The presence in London recently of Sir CHARLES SMITH, K.C.M.G., of Durban, President of the South African Sugar Association, led to his being entertained at a public luncheon given to him in the Vintners' Hall, London, by the Sugar Federation of the British Empire. The new President of the

Federation, Mr. L. S. AMERY, M.P., formerly Secretary for the Dominions in the last Conservative Government, presided over the function and made an interesting speech, in the course of which he gave some figures to illustrate how the Empire production of sugar has been expanded during the last 15 or 20 years. When the War broke out in 1914 barely 8 per cent. of this country's sugar supplies was drawn from the Empire. Since the war, however, Government policy had altered, and had gone some way to foster this vital industry. In Australia the production has risen from 160,000 tons in 1919 to 532,000 tons last year, while in South Africa the production was 163,000 tons in 1924-5 and for the current year is estimated at over 300,000 tons. Since the preference was given, South Africa has bought at least two million pounds worth of sugar machinery and equipment from this country. In the case of our sugar producing colonies such as Mauritius and the West Indies, which had no home market, they had, thanks to the preference, been able to maintain themselves instead of becoming, as they otherwise would, bankrupts, dependent on the charity of the Mother country. Mr. AMERY added that the home sugar policy had also succeeded under the protection of the subsidy; and taking beet and cane the proportion of our sugar now supplied by the Empire was nearly 40 per cent. In conclusion he pleaded for continuity in the policy that had been built up in the last ten years. The sacrifice of a system in which so many lives were concerned could not be justified for any merely theoretical satisfaction.

SIR CHARLES SMITH in the course of a short speech stated that progress in the South African sugar industry had been interrupted by the uncertainty as to whether the Imperial preference would be withdrawn by Mr. SNOWDEN or not. They were however doing their best to develop their industry and the question of making motor fuel from their by-products was being considered. They proposed to extend their distilleries in order to utilize large quantities of the inferior grades of sugar for the production of alcohol, which they hoped to market at a cheaper rate than that of petrol. Indeed, he was beginning to think that one day sugar might be only a by-product of the process.

LORD BIRKENHEAD, speaking as a director of TATE & LYLE, referred to the increase in employment that had followed our recent sugar policy at home and said he could not believe that any such fiscal changes as were apprehended at the hands of the present Government could be contemplated by those to whom responsibility in the matter was at this moment committed; the incubus of unemployment loomed too large. In this respect he expressed his admiration of the rare courage shown by Mr. J. H. THOMAS in endeavouring to solve the unemployment problem in this country, and said that Mr. THOMAS was undeserving of the political criticism and sometimes ridicule to which he was continually subjected.

Affairs in Jamaica.

The crisis in the sugar industry in Jamaica has been met by the local Legislature, due to the wise statesmanship of Sir EDWARD STUBBS, in a very substantial way, namely the retention of the local market with its existing preference for the benefit of the industry, by making compulsory the exportation of such sugar over and above the probable Island consumption, which in this case is fixed at 20 per cent. of the output. The probable benefit to the planter on the 20 per cent. will be in the region of £3. 10s. per ton over the market price, and the Government is to grant a subsidy of £2. per ton on the 80 per cent. exported. Realizing that whatever steps the Sugar Commission may take they would not have been effective for the present crop, which

has already started, the planters urged on the Government the necessity of taking such action as would tide them through until the Imperial Government's measures were made known.

In operating the sales of sugar locally there has been appointed a Sugar Manufacturers' Board consisting of seven representative planters, who will become the Single Seller of all local sugars, and they have appointed Messrs. BRYDEN & EVELYN their brokers. There is a further Board appointed by the Government which fixes the grades of sugar and retail prices, to prevent exploitation of the local market, and which furthermore grants licenses for the importation of refined sugar, which it is hoped will be kept down to a minimum figure. Mr. F. M. KERR-JARRETT is Chairman of the Sugar Manufacturers' Board, while the Hon. F. C. WELLS DURANT, Attorney-General, is Chairman of the Government Sugar Board.

It is to be hoped that the operation of these Boards will be of lasting and permanent benefit to the industry, as being the initial stage of co-operative marketing, since each plantation has the supplying of the local market to the extent of 20 per cent. of its output, thus eliminating the hitherto unsatisfactory under-selling and unnecessary cutting of prices.

The Glasgow Sugar Machinery Market during 1929.

According to the *Glasgow Herald*, the low price of sugar during 1929 resulted in little or no money being available for improvements and alterations to existing sugar factories, and proposals for complete new factories were disappointingly small. In common with certain other commodities, the production of sugar in the world went ahead of consumption, and the numerous duties which have been levelled on sugar in every country in the world did not tend to improve the consumption. As a result, for the small amount of work which was offering, competition was extremely keen, not only among home manufacturers, but also with American and Continental machinery manufacturers.

South African customers are still taking a certain amount of plant, owing to the fact that they are in a favourable position, in that their industry is very highly protected. Messrs. Duncan Stewart & Co., Ltd., Glasgow, secured an order in that market for what is probably the most up-to-date electrically-driven milling plant in the world. This plant is of the largest size which is made, and embodies many novel patented features. The order was particularly gratifying, as severe competition was met, and the work was placed, not on the lowest price, but on the design and specification. An appreciable amount of work was secured for British India, but at prices which leave little or no profit to the manufacturer.

WORTHINGTON FREFLO CENTRIFUGAL PUMPS.—In the advertisement of these pumps appearing on page xxvii of our January issue a slight error crept into the description. "Syphon air and water seal" should have been "Sylphon air and water seal."

JAVA MEDICAL ORGANIZATION.—In Java, though most of the sugar factories have an individual medical service there is no exchange of information amongst them, as is so in agricultural and technical matters through the Experiment Station. Dr. P. W. L. Penris[1] therefore proposes that the Syndicate should establish a central medical bureau to remedy this defect. Inspectors from this bureau would visit estates to report on sanitary conditions, then this information would be disseminated, and advice given.

[1] *Archief*, 1929, 37, II, No. 31, 727-731.

The Beet Sugar Subsidy.

Debate in the House of Commons.

Owing to the Government having to introduce a Supplementary Estimate into Parliament to provide for the payment of a larger sum by way of subsidy to the home beet sugar industry than was calculated a year ago to be necessary, a debate lasting nearly four hours took place in the House of Commons on January 23rd last and ranged over different aspects of the sugar beet industry.

The Minister of Agriculture (Mr. Buxton) in explaining the reasons for needing the extra sum of £1,250,000 stated that when the original estimate for the 1929 requirements was made a year previously, the expected acreage was put at 205,000 acres, but in the end the figure proved to be 230,000, while the yield per acre was a record one of 2810 lbs. or 8·65 tons, with a sugar content averaging 17·7 per cent. This year the acreage is expected to be 315,000 or more. He expressed satisfaction at the increased efficiency which had come about in the course of the last three years in the production of sugar beet. He had always felt that by far the most important justification for this expensive experiment, and the chief value that would lie in it, was in its educative value towards better crops : the standard of farming generally over a very large area had been favourably affected. Then implemental cultivation had been given a great fillip ; up to two years ago something like £15,000 had been expended throughout the beet acreage on better implements, and a great advance had been made in encouraging farmers to use deeper ploughing. Growers had told him of the extraordinary effect that the beet crop had on wheat, not in the next year, but three years after the beet crop in a four-year rotation.

Mr. de Rothschild (Isle of Ely, Liberal) urged that the grower was not getting his fair share of the profits, and he reminded the Government that six months ago they had stated they were about to hold an enquiry into the working of the beet industry, and he asked that the promise should be fulfilled.

Miss Picton-Turbervill (The Wrekin, Labour) a new member, made a speech that was favourably commented on on all sides of the House. She remarked that the story of the growth of the beet sugar industry made a most romantic chapter in the industrial history of this country. She supported the subsidy on account of the benefit it had brought both to the farmer and to the agricultural labourer in those counties where sugar factories existed. She had been over these factories and considered them a revelation of economy and efficiency. She instanced in particular the sugar area where her constituency lay, the Kidderminster area, where a large number of depressed farmers and their labourers had experienced a turn in their fortunes and were now enthusiastic about sugar beet cultivation.

Sir Godfrey Collins (Greenock, Liberal) complained that the beet factories after being subsidized out of public funds and also having borrowed £2,000,000 under the Trade Facilities Act, were now buying foreign sugar in their off season and so competing with the existing home refineries. He hoped the Government would not countenance that.

Mr. Louis Smith (Sheffield, Unionist) expressed satisfaction at the increasing interest the labour members were taking in the problem of establishing a sugar industry in this country. Referring to the share the factories had in the profits of the venture, he reminded the House that the factories were doing a great deal for the farmer. They supplied him with seed, they found his labour for him, and paid for it long before they got their money. They also furnished him with manures on long credit terms, sent him the

labour for getting in his crop, and not only found the money for the labour but took a good deal of trouble in providing hands in outlying parts where the farmer had difficulty in obtaining assistance; thus they made it possible for the farmer to get his return which was always certain.

Mr. SAMUEL (Farnham, Unionist) discussed the balance sheets presented to the Ministry under the Sugar Subsidy Act of 1925, and questioned the value of the auditors' certificates given with them in respect to valuations of stocks on hand.

Dr. ADDISON (Parliamentary Secretary to the Ministry of Agriculture) thought they could congratulate themselves on the particular unanimity in the debate, for with the exception of Sir GODFREY COLLINS there appeared to have been no hostile criticism. The enquiry asked for by Mr. DE ROTHSCHILD into the general conditions of the beet sugar industry was instituted some time ago and was at present proceeding, and he hoped to be able to publish the Report by some time in June next. As for the farmers, they were not dissatisfied with the result of their bargain, for although the basic price last year was 46s., the good yield and sugar content had raised the net return to an average of 52s., and farmers as a whole found this as remunerative a part of their work as any. In some parts of the country the beet crop had been almost the salvation of agriculture in 1929, and the one crop practically in regard to which they could say that they had done good.

Major GEORGE DAVIES (Somerset, Unionist) remarked that he had been connected with the sugar industry in its various aspects for over 40 years, in Formosa, in the Philippines, in Cuba and in Porto Rico, and he emphasized from his long experience the difficulty of putting a new sugar undertaking on a paying basis without some years of experimentation. He urged that the industry could not be said to cover England till they had a sugar factory in operation in the south-west of England; the acreage was waiting but the factory was not there. He remarked that once on a time the most important person in the sugar industry was the agriculturist who grew the crop; then the engineer-minded man came to the front; but now, thanks to Java's example, the most important person in the industry was the chemical director. The sugar industry was a highly chemical industry, and there was a great opportunity for the young men of our universities to take their degrees in science and turn their acquired knowledge into commercial channels, amongst which the new sugar industry offered them a great field.

Sir G. COURTHOPE (Rye, Unionist), speaking both as a factory director and as a contract grower, said that his early deliveries from heavy clay land in 1929 brought him in £45 an acre in cash, while the cost of cultivation was £19 per acre, to which he added 25s. the equivalent for rent. Bad weather affected his later deliveries, but his total receipts for the season were more than double his total costs. Admittedly, however, it had been an exceptionally favourable year.

VISCOUNT WOLMER (Aldershot Unionist), urged that in the event of further factories being started in new localities, a new subsidy of equal amount and duration with that given already to the earlier started factories should be extended to the newcomers, so as to put them on an equally favourable footing from the financial point of view. Otherwise, there would be no incentive for capital to be offered to erect further factories, including one much needed in the West of England.

The Supplementary Vote was finally agreed to without being put to a division.

Leaf Scald.

A short description of Leaf Scald, a destructive cane disease in Australia and Fiji, was reproduced in our July number of last year,[1] in order that planters might have at hand a ready means of detecting and excluding it. Its resemblance to and distinction from gumming were emphasized ; but the disease was of comparatively remote interest, as it was apparently confined to the Far East. Since that description was written, however, it has been recorded from Mauritius, masquerading under gumming—and it may very well occur anywhere in like manner. It is thought worth while, then, to give a fuller account of leaf scald, and this has been made the more easy by a recent publication by D. S. NORTH,[2] who has been working for years at the disease in Queensland, New South Wales and Fiji. This paper although a condensed account of a more scientific Monograph runs to 48 pages, and is consequently difficult to compress, but an attempt has been made to extract its more important points.

The author has traced leaf scald in Australia with certainty as far back as 1911. He regards it as probable, however, that it occurred there before 1900, being introduced from New Guinea or Java. This early introduction is strongly suggested by the reported behaviour of Mahona, the most susceptible variety (No. 22 of Tryon's collection of New Guinea canes in 1896), of which it is recorded that " it matured early and died off," just as it has done since, and has therefore now been discarded. He further considers that other cane varieties in Australia and Fiji have suffered in a similar manner, for at the present time the standard canes grown are mostly strongly resistant to leaf scald.

Within recent years, many surveys of very varying thoroughness have been made of the distribution of cane diseases in Australia and Fiji ; from which it appears that the present concentration of leaf scald lies chiefly in the three northern districts of Queensland, Mossman, Cairns and Johnstone River, and the Tweed River district (the border river) in New South Wales. Now and then it is found as well throughout the cane tract, but chiefly as isolated cases, and is even entirely absent in places. It has also occurred in Fiji, but is stated to be now largely under control. Attention is drawn to its greater prevalence in the wetter, as contrasted with the drier tracts, suggesting that wet weather may have something to do with its dispersal.

But a much more potent factor in dispersal has been discovered, namely, that Badila acts towards leaf scald as a tolerant carrier. Almost every field of this cane in the northern districts is infected, and so they are in the Tweed River tract, where Badila is the standard cane. In such circumstances no ready means of control can be suggested, excepting the finding of another equally good variety which is highly resistant. Although unmistakably present through numerous small signs, the disease in the Tweed River district appears to be doing small damage. And the author considers that any attempt at replacement would probably be more costly than leaving Badila alone ; and that any cropping of lands unsuited to the standard cane with less resistant varieties will be a very risky proceeding, however carefully selection is applied.

This behaviour of Badila of course reminds one of the earlier POJ's and mosaic. But one cannot consider the matter as quite so simple, for the author also states that Badila is not consistent in its behaviour, in that it does not thus act as a carrier in the Herbert River district, although the climate

1 *I.S.J.*, 1929, 366.

2 " Leaf Scald Disease of the Sugar Cane and its Control." D. S. NORTH. Agricultural Report No. 9 (condensed version of Agricultural Report No. 8, Technical). Colonial Sugar Refining Co., March, 1929.

is similar to that of Cairns. Here, in fact, Badila is a leading variety and yet leaf scald has been found to be readily controllable in the growing of the less resistant varieties referred to above, namely CLARK'S seedling (HQ 426), the Gorus (NG 24, and its sports NG 24A and NG 24B) and others.

The relative susceptibility to leaf scald of the different varieties grown in the sugar cane tract of Australia thus becomes an important study. At present this study is incomplete, but from the data available a Table has been prepared, giving also details as to the extent of the observations on which it is based. The list is reproduced here, without these qualifying remarks. It may be noted that the list also gives the order of susceptibility, commencing with the most susceptible and passing onwards to those less and less so.

Susceptible : Mahona, HQ 243, 7R 96, 8R 31, HQ 114.

Moderately resistant : Nanemo, Oramboo, Korpi, HQ 426, 7R 428, NG 24, NG 24A, NG 24B, NG 16, M 1900 seedling.

Susceptible but tolerant : Badila.

Highly resistant : Malabar, NG 14, Innes 131, D 1135, H 109, HQ 5, HQ 409, Q 813.

The *losses* caused by leaf scald are difficult to determine, because of its scattered nature and differences in the severity of attack. As canes are sometimes killed outright, in certain cases whole fields have been destroyed ; but more usually the destruction is only partial, and in slightly affected crops the damage appears to be negligible. Detailed estimates were however prepared by the author of the losses incurred in Mahona crops on the Richmond river during the four seasons 1920-1923. About 750 acres were harvested each year, and during the four years 1694 acres suffered injury, 752 acres severely and 942 only slightly. The losses in tons of cane were put down as 940, 2017, 2179, and 2570, making a total of 7706 tons of cane during the period. Nearly all these losses occurred in the 752 acres severely attacked : 31 of them were a total loss, 378 acres suffered a loss of 25 per cent. and upwards, and the remaining 343, 10 to 25 per cent.

Besides these direct losses others must be included. For instance, the loss of the ratoon crops caused by ploughing out the canes, and the serious reduction in the quality of the canes harvested But in all probability the most serious blow was that such a fine standard cane, as the Mahona had proved for the district, had to be abandoned.

Leaf scald appears in two phases, the chronic and the acute ; and these affect the cane in such different manners that, up to 1919, they were regarded as entirely different diseases. They are often met with separately, but it is more usual for them to grade into one another.

The *chronic phase* is shown by odd, stunted canes with shortened, stiff, upward curling leaves, withered at the tips ; some leaves being white (chlorotic), and side shoots sprouting from every bud. Straight, narrow, whitish leaf streaks appear, many running the whole length of leaf blade and leaf sheath. Frequently only one, two or three canes in a stool show these characters.

The leaf streaks present the best symptom of the disease, and should always be looked for. On newly attacked plants, a single white line on one leaf is often the only evidence. In older plants (one year old), the sprouting of a single bud, followed by those above and below it on the same side of the stem, is sometimes the first sign ; but this is soon followed by leaf streaks, and these more usually appear first. Shoots from diseased cuttings or ratoons are sometimes obviously diseased without the appearance of streaks.

Leaf Scald.

In young canes the streaks are usually clear and well defined and the other symptoms follow slowly; but in older canes the streaks often become obscured by partial withering, and they must be looked for on the leaves of side shoots or small suckers. Prior to withering, the streaks become broader and more diffused, gradually developing into broad withered stripes, the withering commencing at the tip and spreading downwards. The remarkable straightness and evenness of the streaks is due to their strictly following the course of the veins of the leaf.

In the *acute phase*, whole stools or parts of them suddenly wilt and die; and sometimes this occurs in whole fields, as if their roots had been cut off. This phase is usually seen in dry weather and when the canes are approaching maturity, the canes alongside remaining green and healthy. The effect resembles a severe grub attack, and in north Queensland damage done by leaf scald has often been attributed to white grub. Such canes may show none of the symptoms mentioned above: but if diligent search is made some of them may in cases be readily found, while in others it may be necessary to wait for the new shoots developed after the cutting of the canes.

The *internal symptoms* also differ in the two phases. Considerable reddening of the tissues is met with in the canes with chronic symptoms. On closer examination, the reddening is seen to consist of extremely fine, bright lines of colour in the fibres (fibrovascular bundles) of the cane stem, and they are found to be confined to the delicate water bearing vessels in these bundles. They are most distinct in the lower, mature part of the cane, and occur mostly near the nodes (where the buds arise); but they are also present in the young tissues of the cane top, and of side shoots just sprouting. Such reddened fibres are also seen in the water vessels of the veins of the leaf sheath, and to a less extent in the leaf blade. Canes killed in the acute phase of leaf scald show no red or other internal symptoms of the disease: their tissues appear to be perfectly normal and healthy. Where side shoots have arisen there is reddening, but this must be put down to the presence of the chronic phase as well as the acute.

The *causal agent* of leaf scald is an extremely minute bacterium, at present unnamed, but differing from that causing gumming. It occurs in countless numbers in the reddened vessels of the stem fibres and under the leaf streaks. When, in severe cases, the vessels are destroyed, the bacteria also invade the surrounding tissues, ultimately producing cavities in it. The reddening spreads to these cavities, which then appear as reddened patches. This phase is illustrated by the description of a large streak, where the cavity was over a foot in length, and the leaf sheath was split for several inches, thus spreading the bacteria over the tender organs still enclosed by it.

The reddening of the vessels is, as usual, accompanied by the formation of wound gum, which blocks the cavity of the vessel and cuts off the water supply. A vessel at any place may have gum alone, bacteria alone, or gum with bacteria imbedded in it. Such wound gum is commonly formed when the tissues of the cane plant suffer from any injury, and is merely the result of the dying of the tissues. It has nothing to do with the masses of gum poured out by bacterial action, which is so marked a feature in the disease called gumming. It is, in fact, only discernible in the vessels by careful microscopic examination.

These bacteria of leaf scald have been isolated, multipled in pure culture, and inoculated into healthy canes, thereby transferring the disease to them. It was at first extremely difficult to build up a suitable medium for their

growth; but, after many combinations had been tried, several which answered fairly well were discovered. The organisms appear to be delicate, and grew only slowly in most of the media prepared by the author. But it is a significant fact that, when he tried the mixture used by WILBRINK in her studies of *gomziekte* in Java, a great improvement took place, and this formula is recommended by him for the study of leaf scald.

A series of *inoculation experiments* are then described. Cuttings were successfully treated by dropping pure culture over their cut ends, as also on leaf scars and young healthy buds. For the inoculation of growing parts, a hypodermic syringe was used, piercing the growing point at the top of the cane, and this proved successful. On the other hand, repeated attempts at injecting pure cultures into green leaves or mature stems only ended in failure: the disease did not appear, at any rate within a few months.

The *spread of the disease* in the plantations is brought about in three main ways and also probably in a fourth : by planting diseased material, by using infected knives, and by some means at present unknown but suggestive of an insect carrier ; and also, apparently, from root to root in adjacent plants. The most important of these is undoubtedly the use of diseased planting material—cuttings from diseased plants. There is little doubt that by this means leaf scald first entered Australia, and was then widely spread over the sugar cane tract.

To bring this source of infection under control, the sources of Mahona seed on the Richmond were carefully studied, and divided into three categories : " diseased," " unsafe," and " safe." The seed was considered diseased if even a single stalk in a field was discovered. It was regarded as unsafe if diseased canes were seen within a quarter of a mile ; while it was only termed safe if no suspicion could be entertained. This scheme was put into practice in 1900, and in the following year it was found that all the planters using the first class had disease in their fields ; 20 out of 28 using unsafe seed grew diseased crops ; while those using safe seed had no disease, unless they planted their fields close to diseased crops. In all cases, only apparently healthy stools had been selected for the cuttings.

A serious attempt was then made to build up a healthy crop of Mahona by *selection and roguing* (as in mosaic). This experiment was carried on for three years. Altogether, four large plots were laid down, in each case from stools showing no trace of leaf scald. In the first year 1000 cuttings were planted in what was called Plot 1 and this was ratooned ; in the second year 1000 cuttings were taken from the first plot when the canes were 11 months old, and this was named Plot 2. In the third year two plots were planted from canes in Plot 2 when they were 12 months old ; one of 402 cuttings named Plot 3, and one of 420 cuttings planted at a distance of over a quarter of a mile from any cane ; this was named Plot 4, and was put down to obtain data as to secondary infection.

There was the same course of events in all the plots ; though in the third year the results were complicated by severe drought, from which many of the cuttings failed to grow. During the first few months, numerous diseased stools were detected and removed ; this period was followed by one in which few or no diseased plants were found in the plots ; but as the canes were approaching maturity, a second period of active roguing was passed through. This of course suggested a primary infection where cuttings from really diseased plants had been planted, and a secondary infection where the disease was spread from plant to plant by some hidden agency. Plots 3 and 4 were

differently affected by the drought, in that Plot 3 was situated on loamy soil, and the plants grew more quickly, while Plot 4 was on light sandy soil and the plants grew much more slowly and more succumbed to the drought. There thus appeared to be considerably fewer diseased stools in Plot 4, but the author considers that this was owing to the drought and not to the segregation of this plot.

Controls were introduced from the second year onwards, namely in Plots 2 to 4. In these there was no roguing needed in the first period, but when the plants were about 12 months old or in the young ratoon crops, diseased plants appeared, again suggesting the spread of the disease from healthy to diseased plants. The author concludes from this experiment as follows: "This trial again shows that it is impossible to select healthy seed cane from an infected crop, and that the disease cannot be got rid of by eradicating diseased stools, because many canes carry the infection in a latent, unrecognizable condition."

Further experiments, with *cuttings of different types* of infected crops, showed that those from canes infected by the chronic phase of leaf scald often failed to grow at all, even when the disease was in the first stage of a leaf streak on a single leaf. Therefore, the planting of such cuttings of Mahona "is of little importance in spreading the disease, because they mostly eradicate themselves." There is however danger when the variety is less susceptible than Mahona. Cuttings from apparently healthy stools in infected blocks and from similar canes in diseased stools, usually show no signs of disease for several months; and, to all appearance, the proportion of ultimately infected stools in the first case varies with the distance of the parent plant from the infected stools in the field.

Cuttings from stalks affected with the acute phase, on the other hand, in many cases produced apparently healthy plants, even in cases where all the leaves had withered. This surprising result is explained by the fact that the wilting is due to disease in the underground part of the cane alone. If, however, there were any sprouted buds on such wilted canes, the cuttings behaved exactly as those obtained from stools suffering from the chronic phase.

From these and other data the author concludes that cuttings, from what appear to be perfectly healthy stools, are by far the most dangerous and difficult plant material to deal with. In newly infected canes the parasite is liable to remain for a long period in a latent condition while the cane is actively growing, but any check that it may receive in this growth causes its resistance to be impaired. Such checks occur periodically in the plantations, irrespective of such accidents as periods of drought, etc.: the natural cessation of the actively growing period and the beginning of the maturing stage, harvesting the canes and the commencement of the ratooning stage, and more important still the severe check inseparable from dividing the cane into cuttings. Young plants, whether as plant canes or ratoons, are invariably much more diseased than the crops from which they were derived, and the symptoms of leaf scald regularly show up as the canes approach maturity.

Knife infection was also submitted to tests of various kinds. In one experiment, with infected and sterilized knives, 50 per cent. of the young plants were diseased in the former case, while all were healthy in the latter. And it might be expected that this knife infection would offer an explanation of the fact, that a regular increase in disease is seen in young plant canes and young ratoons, over that in the canes from which they were derived. But

this does not appear to have been borne out in the results of experiments; for in all the four plots in the selection experiment except the first, the cuttings were prepared by sterilized knives. Evidently some other means of dissemination is responsible for this observed increase. None the less, the use of infected knives in a disease-free area would be a most serious matter.

It has been observed that canes, planted within about a quarter of a mile of fields that are affected by leaf scald, rarely survive a season without odd stools contracting the disease; and cases have been met with where the distance was half a mile. Where such odd canes appear, they are generally single or widely separated in the field, near one edge or less commonly towards the middle. In subsequent crops patches of diseased canes frequently develop around these centres: such are well known to the farmers who call them "ringworm" patches.

Two modes of infection from one plant to another have been suggested by the evidence collected regarding this spreading of leaf scald, termed respectively "*bud infection*" and "*root infection*." In the first case, one or more buds are frequently found to be infected on a single stalk, while the others remain healthy. This was well shown in Plots 3 and 4 of the seed selection trials. A diseased and an apparently healthy shoot have been frequently observed to grow from the same cutting. Also the sprouting of a single bud, as the first symptom of the disease in an old stalk, and its dissection clearly indicate the bud as the original site of such isolated infection.

Root infection, on the other hand, is suggested by the acute phase of the disease, where the canes rapidly wilt in patches or over whole fields, the wilted canes themselves when cut not showing the customary symptoms. And the ring-worm patches point in the same direction: to an intense local spreading from root to root. Careful experimental studies have shown that the soil cannot support the bacteria, much less transfer them from plant to plant.

Both methods of spreading leaf scald appear to be of prime importance: bud infection is the main obstacle to seed selection, and root infection appears to be responsible for the acute phase, upon which the destruction of crops mainly depends.

North's paper is full of interesting illustrations, and concludes with a resumé of control measures, a summary and a list of literature cited. Much has had to be omitted in this short abstract which would have made the argument clearer, but it is believed that the main facts have been fairly set forth, for readers to gain a knowledge of this interesting study of leaf scald.

C.A.B.

Molasses Utilization.—Attention has already been called in these columns to the possibility of making citric acid from sugar solutions by a fermentation process.[1] It is now pointed out that the Prager Montan und Industrialwerke vorm. Joh. Dav. Starck have erected a plant for the manufacture of this material using beet molasses.

Deleafing Beets.—In parts of Czecho-slovakia and elsewhere beet farmers have the idea that it is advantageous to remove part of the foliage from the plant during the latter period of its growth. A very careful study of this matter extending over three years by J. Soucek and J. Suk,[2] however, shows that to the contrary both the sugar content and the yield per acre are reduced. Altogether the quality of the roots is lowered by this practice.

[1] *I.S.J.*, 1929, 98, 672.

[2] *Zeitsch. Zuckerind. Czecho-slov.*, 1929, 53, 725-728.

The Java Meeting of the International Society of Sugar Cane Technologists.

With Some Comments.

By ARTHUR H. ROSENFELD,
Delegate of the American Sugar Cane League.

The Third Triennial Conference of the International Society of Sugar Cane Technologists, which was organized in Hawaii during the Pacific Food Conference in 1924, was held in Java from June 7th to 19th of 1929 and may be considered to have been very successful and the matters discussed and places visited during this Conference will prove to be of direct benefit to the sugar industries of all countries represented. Twelve sugar countries were represented, these being Australia, British India, Egypt, Hawaii, Formosa, Indo-China, Japan, Java, Louisiana, Mauritius, Philippine Islands and the United States of America (exclusive of Louisiana.)

The contacts with well-known scientists who represented the various countries constituted one of the great privileges of the meeting, and the many discussions of various important points in cane technology, wherever delegates got together outside of the meetings and during the extremely interesting trips around the Island the second week of the meeting, were perhaps even more valuable than the interesting and illuminating meetings themselves.

It will be noted from the list of countries represented that Cuba had no delegate. This was particularly unfortunate, as the absence of any Cuban representative, or even of a cable of adherence and good wishes, absolutely precluded any entry by the Conference into a discussion of the world economic situation in sugar.

THE GENERAL MEETINGS.

While the actual official opening of the conference took place on the morning of 7th June, the programme was really commenced the preceding evening when everyone got together at the official reception given to the delegates by the city fathers of Soerabaia, where the representatives of the various countries were welcomed to Java in the beautiful new townhall, the reply to the burgomaster's address being made by the universally beloved Dr. JACOB JESWIET, producer of the POJ 2878 cane, who was General Chairman of the Java Conference.

At the opening meeting on the 7th June, the inaugural address was made by Dr. H. JELGERHUIS SWILDENS, the exceptionally able president of the General Syndicate in Dutch East Indies. Dr. H. JELGERHUIS SWILDENS is an economic authority on matters relating to sugar production the world over, and his talk bristled with facts and figures of wide interest.

The first lectures upon the opening of the meetings were devoted to the development of the Java sugar industry from the agricultural, engineering and chemical standpoints by the three directors of these several departments at the Sugar Experiment Station, Dr. V. J. KONINGSBERGER, Director of the Agricultural Experiment Station, Dr. E. C. VAN PRITZELWITZ VAN DER HORST, Director of the Engineering Experiment Station, and Dr. I. P. HONIG, Director of the Chemical Experiment Station. These three talks were ideally planned to give all delegates present a splendid perspective of the Java sugar industry development from the three component angles.

Dr. KONINGSBERGER's paper was interestingly fortified by an excellent series of graphs showing what might be called the effect of the various successive varietal revolutions in Java, as the first bred POJ seedlings began to replace the old striped and purple canes after the sereh outbreak in the early 90's, as these were, in their turn, replaced, and yields increased, by the

adoption of 247 B and POJ 100 and these, in their turn, by EK 28 and DI 52, which were the standard canes until the "wonder cane" POJ 2878 began to replace and show increases and yields over the latter standbys in 1928, being to-day planted on over 93 per cent. of all the Java cane area.

Dr. KONINGSBERGER left to Dr. JESWIET himself, the breeder of the higher numbered POJ canes, the discussion of the development, selection and breeding of the later canes in what was perhaps the key address of the day. In his lecture Dr. JESWIET broadly reviewed the work of his eminent predecessors, beginning with the re-discovery of the fertility of cane seed by SOLTWEDEL (incidentally with the same discovery by HARRISON and BOVELL in Barbados) in the middle 80's, the initiation of controlled or true sexual breeding by KOBUS and enthusiastic cross breeding efforts by MOQUETTE and WAKKER, on up to his own contemporary work, in which he was ably assisted by Miss WILBRINK, the Vice-Director of the Cheribon Experiment Station, and the notable cytological work of Dr. G. BREMER. The breeding of POJ 2878 by Dr. JESWIET is one of the outstanding accomplishments in the whole history of genetics. Brought from Holland for the special purpose of breeding cane which should have the desired qualities of high tonnage and sugar content resistance to the worst diseases of Java, an erect type of growth, easy shedding of the leaves and a deep root system, Dr. JESWIET in just eleven years of intensive breeding and the most rigorous elimination of all canes not showing characteristics he desired, so remarkably attained the goal he had set himself that this POJ 2878 cane within two years of its actual release has practically entirely replaced the exceptionally fine canes which were already being grown in Java and which were themselves the result of the most careful breeding and selection by Dr. JESWIET's eminent predecessors.

The second day of the meeting was devoted principally to two general papers, the first by Dr. H. GERBER on "Irrigation, its Organization and Importance to the Java Sugar Industry," in which an excellent idea was given of the general scheme and practice of irrigation in the sugar zones of the Island, and which was a useful predecessor to the excursion the following day over the Sidhoardjo Irrigation Works.

The next address, by Dr. G. H. C. HART, was on the "Economic Advantages and Drawbacks of the Sugar Industry in Java," and, in the writer's mind, was one of the most outstanding papers of the entire Conference—in fact, the most interesting and well presented economic paper that he has ever heard. Thoroughly familiar with the psychology of the native Javanese or Malayan, with a deep sympathy for their problems, and yet with long experience of the problems confronting Dutch manufacturers of sugar with all of the restrictions necessarily thrown around the sugar industry by the government, Dr. HART, in a most scholarly way, and, at the same time, with a wonderful touch of humour, which at all times held the intense attention of his hearers, reviewed the whole development of the sugar industry in Java from the economic standpoint, discussed the maze of laws and restrictions thrown about any future expansion as far as acreage is concerned, and strongly emphasized the small possibility of the government permitting any large amount of additional land being devoted even temporarily to the production of sugar, even though the acre value of the sugar crops might be so much in excess of that of rice that the corresponding amount of rice might be imported and still leave an excellent surplus to the credit of the acres devoted to sugar cane. As is commonly known, the Dutch, in their remarkably far-sighted colonial policy, recognizing the childishness and poverty of the natives and the likelihood of their trading or selling their lands to Euro-

peans and thus becoming entirely a dependent labouring population, have, for three centuries, tenaciously adhered to their policy of keeping the land in the hands of these natives. No European may purchase land of any agricultural value in the Dutch East Indies, nor may he even sign long leases. If a native borrows money on land from a European, this land cannot be foreclosed upon. Furthermore, it has always been the policy of the Dutch Government to have the natives produce as large a part as possible of their own food, which is principally rice, and the government, in giving licences for the leasing of lands for growing other crops, will not permit that a crop like sugar cane be grown for more than one year consecutively on that land. This means that the sugar company, in arranging leases for land with which to supply its factory with cane, must lease three times the area normally required, because only plant cane may be grown, and, when the plant cane crop is taken off, the land must be devoted to the production of rice for two successive years thereafter before it can again be put into cane. This, of course, in turn signifies that, once the land is put back into cane again. if the short leases are continued, the fields have to be laid out anew, the complicated system of Reynoso ditches in which the cane is planted re-dug, and irrigation and drainage ditches put in anew, all of this work being done almost entirely by hand; this added to the fact that the stubble, which could produce a very cheap and abundant crop, must be destroyed. From the standpoint of the agriculturist, it was heartbreaking to see the stubble of fields of POJ 2878 in Java, which had yielded above 100 tons of cane per acre, being dug out to make ready for a succeeding rice crop. As the writer told Dr. Hart after his really masterful address, it seemed that he could well have left out the word "advantages" in his title and called his paper the "Economic Drawbacks of the Java Industry."

On the night of the 8th June, the delegates were practically given a trip to the little known Island of New Guinea when Dr. Jeswiet showed the moving pictures and slides of the American Sugar Cane Expedition to that primitive island in 1928, which our readers will all remember as the cane collecting trip headed by Dr. Brandes last year. Dr. Jeswiet, with characteristic ability and humour, discussed the trip and its results as the pictures were shown. One of the outstanding scientific results, and one which may have considerable application from the cane breeding standpoint, was the discovery by the expedition of an enormous new species of sugar cane, which Dr. Jeswiet is now describing as *Saccharum robustum*. Some 125 new varieties of cane were brought back to the United States by Dr. Brandes, a duplicate collection is growing in Australia, and it is confidently hoped that the use of these many new strains in breeding work may result in yet better canes for the particular conditions of various countries.

Another interesting film was the official one of the General Syndicate of Sugar Manufacturers on the Java Sugar Industry, which was shown to the delegates on the night of the 11th June in the delightful open-air theatre of the "Art Circle." In this film every phase of the Java sugar industry was shown, including native types and methods of living, the agriculture of the cane from the beginning of the preparation of land to the delivery of the cane on the conductor, the work of the great experiment station at Pasoeroean, all phases of sugar manufacture and machinery, and even details of shipping the product to various countries.

At the official reception of the General Syndicate on the night of 13th June, a most remarkable film prepared by Dr. E. H. Hazelhoff, Entomologist of the Experiment Station, was shown. This film was on the biological control

of the cane borer, and, as a result of what must have been most remarkable patience and dexterity on the part of Dr. HAZELHOFF, showed every phase of development of *Trichogramma* and other borer parasites, both egg and larval, from the deposition of the egg by the tiny wasp, or fly, through the development of the diminutive larva within the egg, the emergence of the parasitic larva, or grub, from its egg and its feeding within the body, or egg, of its host to the final emergence of the adult parasite from its destroyed host.

QUARANTINE, INSECTS AND DISEASES.

On Monday, June 10th the sectional meetings commenced and ran through most of the week. Under Protective Sugar Cane Quarantine, of which section Miss Wilbrink acted as Chairman, there were three interesting papers as follows : "Report of the Committee on Protective Sugar Cane Quarantine ' by Dr. E. W. BRANDES ; " Some New and not yet Described Diseases of the Mosaic Type " by Miss WILBRINK ; and " Sugar Cane Restrictions " by Dr. H. B. SHAW of Hawaii.

In the Section on Insect Pests of Sugar Cane, over which the writer presided as Chairman, the following papers were given and discussed: "Biological Control of *Oregma lanigera* in Java." " Determining the Damage Done to Sugar Cane in Java, by the White Top-borer and the Striped Stalk-borer," and "Mechanical Control of the White Top-borer in Java," all three by Dr. HAZELHOFF. " Sugar Cane Insects of North America and the West Indies, excluding Cuba " by Dr. T. E. HOLLOWAY, of Louisiana. This is a carefully compiled bibliography of known parasites, insects, predators and diseases. " Summary of Investigations of the Soil Fauna of the Sugar Cane Fields in Hawaii," by Mr. R. H. VAN ZWALUWENBURG. As in Louisiana, Mr. VAN ZWALUWENBURG finds that two nematodes—*Tylenchus similis* and *Heterodera radicicola* are most largely responsible amongst the micro-fauna for injuries to cane roots in Hawaii.

In the Section of Diseases of Sugar Cane, presided over by Dr. RANDS of Louisiana as Chairman, there were four very interesting papers as follows : " Fungi associated with Root Rots of Sugar Cane in the Southern United States." In this paper Dr. RANDS laid particular stress upon the aggressive root rotting organisms of the genus *Pythium*, to which Dr. EDGERTON in Baton Rouge and Mr. CARPENTER in Hawaii have been giving much attention. " Pythium Rot in Hawaii," by C W. CARPENTER. This interesting paper deals largely with the relation between Pythium root rot and what is known as Lahaina Disease in Hawaii. "Mechanical Transmission of Mosaic " by Miss G. WILBRINK. During the discussion of this paper it was brought out that Mr. F. SEIN had developed a simple method for the mechanical transmission of sugar cane mosaic at the Porto Rico Insular Experiment Station for use in the testing out of varieties as regards natural resistance to this disease. The device seems to be a very simple one, consisting of a number of pin points at the end of a small handle, and, with this device, Mr. SEIN has succeeded in a great many cases in transmitting mosaic from an infected plant to an unaffected one simply by pricking the leaves of the affected plant first and then proceeding to do the same thing with the leaves of the healthy plant. " Different Forms of Top Damage " by Miss P. C. BOLLE. Dr. BOLLE divides top rot into three distinct types : First, that caused by lightning injury, then that caused by red stripe disease, to which POJ 2878 seems to be particularly susceptible, and then what is commonly know as *Pokkahboeng*. There was considerable discussion in the meeting in attempting to differentiate these three, or really two, principal forms of what is commonly called *Pokkahboeng* by adopting a distinct name for each.

The Java Meeting of Sugar Cane Technologists.

Cultivation and Field Operations.

Under Cultivation and Field Operations, the following were the principal papers presented and discussed; Dr. Koningsberger acting as Chairman of this important Section. "Co-operation between Growers and Millers of Cane Sugar," by Mr. Noel Deerr, of India, and another paper on the same subject prepared by the late F. S. Earle just before his untimely death. Discussion of these papers, which was extremely animated, seemed to show that economic conditions in the different countries growing sugar cane are so distinct that, while the different forms of co-operation are very interesting, very little of the system of one country can be often applied to another. "Cane Cultivation in North India," an interesting discussion of primitive conditions and the outlook for improvements of these, by Mr. Noel Deerr and Mr. C. G. Atkins. "General Remarks on Cane Cultivation and Field Operations in Java." a useful outline on field methods in Java by Dr. Koningsberger. "Cultivation and Field Operation of Sugar Cane in Mauritius" by Mr. A. Tempany, and "In Fiji," by Mr. H. F. Clark.

"Field Experiments with Sugar Cane in Java and the Results Obtained" by Mr. G. Booberg,—a detailed discussion of the system and application of the tremendous number of field experiments, such as no other crop can probably boast of anywhere in the world, carried out at the Java Experiment Station and on the co-operating plantations. It is impossible to exaggerate the importance of these experiments to the comprehension and solution of problems in the domain of cane culture. Practically all advice given by the experiment station is based on these experiments. By means of these field trials there have been definitely determined the varieties of cane which are best adapted to the district soils and climates of the diverse regions of the Island, the fertilizing programme for each section and cultivation procedure with the different varieties and under varying local conditions. To give an idea of the enormous range of these experiments, it might be mentioned that up to and including the campaign just finished 21,672 complete field experiments and 1103 provisional ones, or a total of 22,779 experiments have been carried out, recapitulated and the results published by the Experiment Station with the indicated recommendations.

"Plot Arrangements and Some Results of Variety Tests in Louisiana," by George Arseneaux, of the Federal Experiment Station at Houma. This paper by Mr. Arseneaux was well thought out and presented and received much commendation from the delegates. "Tillage in Java," by J. van Dyk,—mostly a discussion of the remarkable adaptation of the Reynoso system of land preparation under which by far the greater part of Javanese cane is grown. "The Tractor in Cultivation" by D. Sturrock, of the Hershey Agricultural School. "Real Progress in the Louisiana Sugar Industry," by Arthur H. Rosenfeld. "Utilization of Certain Nitrogen Compounds by the Sugar Cane," by J. H. Pardo. "Manure and Manuring in Java Sugar Cane," by G. Booberg. Only two nutrients are of paramount importance for the fertilization of sugar cane in Java. Nitrogen is used on all soils, mostly in the form of sulphate of ammonia, and phosphoric acid on the poorer and older soils only. An idea of the comparative uses of nitrogen and phosphoric acid on Java soils may be obtained from the fact that sulphate of ammonia was applied to 193,300 hectares in Java in 1928 while super-phosphate was applied but to 31,800. Mr. Booberg considers that about 10 per cent. of the soils of Java show sufficient phosphate deficiency to respond to artificial application of this nutrient, while the extensive experiments carried out for years in Java

by the Experiment Station Field Service have shown no effect whatsoever from applying double super-phosphate on those soils, comprising around 90 per cent. of all Java cane soils which analyses show to be rich in phosphoric acid. "Plant and Plant Material in Java Sugar Cane," by J. VAN DYK. "Comparative Study of Yields obtained from Cane Cultivation in Hawaii, Java and Mauritius ' by M. DOGER DE SPEVILLE, manager of the Mon Desert Sugar Company of Mauritius. "Report on Sugar Cane Soils," by H. F. EASTERBY, Director of the Bureau of Sugar Experiment Stations of Queensland, Australia.

VARIETIES.

The Section of Varieties was presided over by the Chairman, Mr. WILLIAM W. G. MOIR, of Hawaii, who made a lengthy and most interesting report for his Committee. The three other outstanding papers presented and discussed in this section were :

"The Present State of the Cane-breeding Work in Java," by Dr. O. POSTHUMUS, a very interesting discussion of work being carried on by Dr. POSTHUMUS in cane-breeding since Dr. JESWIET returned to the Agricultural University of Holland some three years ago. Dr. POSTHUMUS explained in his paper that the goal, of course, of his endeavours is to obtain a better cane than POJ 2878, although he realizes that this is a far more difficult task than it was in the early days of plant breeding in Java to find better canes than those commonly in use. He thinks that in the future other varieties will come to the foreground which will, at first, prove to be superior to POJ 2878 only under special conditions, but that gradually a better and slightly heavier-producing, all-round cane than even 2878 may be evolved as a result of the persistent breeding programme of the Java Sugar Experiment Station. Dr. POSTHUMUS in his paper drew an interesting comparison between the work of a cane-breeder and that of other experiment station workers. He pointed out that the cane-breeder does not start every day and finish at stated intervals some portion of his work which can be piled up step by step towards future results. The cane-breeder must do a tremendous amount of work in testing and then discarding tens of thousands of seedlings, on which he spends the very best of his efforts, but which work will prove to be of no conspicuous value to the industry and must always remain obscure. After years of this sort of careful work, a recompense may be found in the outstanding success of one or a few plants, the appearance and level of production of which must, at the best, depend to a certain extent upon pure chance. For those who judge his work, these few canes which may perhaps come to the foreground are the only ones taken into account, quite naturally, but the thousands of other seedlings which enabled him to draw his conclusions, and which consumed far more of his time and his energy, will never have the slightest value or interest.

"Problems for the Sugar Cane Breeder" by T. B. VENKATRAMAN, of the Coimbatore Experiment Station of India. Mr. VENTKATRAMAN's paper was notable for its originality and for the range of imagination applied to it. "Short Remarks on the Cytology of *Saccharum*," by G. BREMER, an extremely technical but valuable paper, on the investigation of the chromosome numbers of sugar cane varieties which is entirely unique in its field. It was largely through this unusual work of Dr. BREMER that Dr. JESWIET was able to prove his theory that the Kassoer cane, formerly supposed to be a wild cane, is in reality a cross between one of the wild canes of Java, known as Glagah, and the cultivated sugar cane.

A discussion of the field trips of the Cultivation and Field Operations Sections must be deferred for a later paper.

Industrial Dehydration of Alcohol.

Production of Water-free Alcohol for Motor Fuel, etc.

By H. GUINOT.

Absolute (water-free) alcohol has become in less than ten years an important industrial product in every country where alcohol is used as a combustible liquid, either alone, or in admixture with petrol (gasoline) or benzol. It is necessary, in fact, that alcohol should be anhydrous, or almost so (99·7 per cent.[1]) so as to be miscible with hydrocarbons in all proportions at the lowest temperatures. Before studying in some detail the dehydration process involving the distillation of alcohol in the presence of hydrocarbons, which is by far the most generally employed, we will rapidly review the principal processes which heretofore have been proposed, though with slight success, for making absolute alcohol.

PROCESSES USING DEHYDRATING SUBSTANCES.

Lime.—On heating strong alcohol in a reflux condenser apparatus with 30 per cent. of its weight of caustic lime, and distilling after a few hours, one obtains about 60 per cent. of alcohol in the anhydrous state. By heating the lime residues with steam, 30 per cent. of the alcohol can be recovered, more or less hydrated; but 8 to 10 per cent. is definitely lost. Such is old industrial practice. With the object of increasing the efficiency of this process, it is recommended that the lime should be made to act on the alcohol heated under a few pounds' pressure; but the improvement obtained is offset by the danger of explosion occurring.[2] Likewise, with the object of accelerating the reaction and giving it a certain continuity, other processes prescribe treatment of the alcohol in the form of vapour. Lime is made to pass through large pipes by the aid of a screw-gear, the alcohol going through the apparatus in the opposite direction before reaching the condenser. Thus rejuvenated, the old lime method might appear to be acceptable; but, despite the ingenuity of the mechanism employed, no such process has been entirely successful industrially up to the present time.

Potassium Carbonate.—Dehydration by potassium carbonate has not met with any better success. Although pure alcohol is slowly dehydrated by this salt, on the other hand the spirit quite readily yields its water when potassium carbonate is made to act on mixtures of alcohol and petrol.[3] However, the difficulties inherent in the progressive displacement of the potassium carbonate in powder or paste have caused the process to be rejected as industrially difficult.

Glycerin.—This method is based on the use of a liquid dehydrant, composed of a solution of potassium carbonate in glycerin. Alcohol vapours are dried by bubbling them in counter-current through this reagent, the glycerin saturated with water and alcohol being freed from these in its turn by heating under vacuum at a high temperature. This method therefore eliminates some difficulties presented by the use of solid dehydrants. Its application, however, has never developed, no doubt by reason of its inconvenience.

Distillation under vacuum.—It is known from MERRIMAN's work that by operating the rectification of alcohol under vacuum, one can avoid the formation of the azeotropic water-alcohol mixture ordinarily encountered when working at atmospheric pressure. Nevertheless, this method does not carry

1 Alcohol concentrations are here expressed as percentages by weight.
2 *Zeitsch. für Spiritusind.*, 1929, No. 19, 154; and 1930, No. 4, p. 22.
3 French Patent 558,287.

the dehydration very far, this being a function of the vacuum under which one operates. Besides, industrially one is limited by the difficulty of condensing the vapours at low temperature, seeing that under a pressure of 95 mm.; the azeotropic water-alcohol mixture boils at 33·3°C., and still contains 0·5 per cent. of water.

DEHYDRATION BY RECTIFICATION IN PRESENCE OF HYDROCARBONS.

Principle.—The impossibility of extracting really anhydrous alcohol by fractional distillation does not depend on any imperfection of the plate column; but on the fact that the column is capable of isolating from a mixture only the most volatile of its constituents. Now, it happens that the most volatile constituent is not pure alcohol, but the mixture of alcohol and water containing 95·5 per cent. of alcohol. This phenomenon, known by the name of azeotropism, is to be observed in the distillation of numerous mixtures of organic compounds. The mixture which in boiling is isolated at the lowest temperature is called azeotropic. Its boiling point and its composition are independent of the content of the liquid with which the column is fed. An azeotropic mixture gives off vapour having the same composition as it itself possesses; in other words, it behaves in the same manner as a pure body.

YOUNG was the first to surmount the difficulty of obtaining anhydrous alcohol by distillation, and this he did by causing the formation of an azeotropic mixture which was more volatile and at the same time higher in water than the 95·5 per cent. mixture, the limit which before him has not been exceeded. He fractionated concentrated alcohol in the presence of certain hydrocarbons, as benzene, which may be called "entraining bodies." The water-alcohol-benzene mixture gave rise on distillation to a ternary azeotropic mixture much more volatile than 95·5 per cent. alcohol. It boiled at 64·9°C (149°F.), and contained 7·4 per cent. of water, 18·5 of alcohol, and 74·1 of benzene. Note that in this mixture the water represents 29 per cent. of the total water-alcohol contained in the distillate.

It was realized from that time that by fractionating 95·5 per cent. alcohol with a convenient quantity of benzene the water could be entirely expelled from the mixture, entraining with it only a part of the alcohol, the alcohol afterwards distilling being anhydrous. Experience has shown this to be so. The principle of the method devised by YOUNG is summarized by the equation (the parts being by weight) :—

(95·5 parts of alcohol + 4·5 parts of water[1]) + 45 parts of benzene = (45 parts of benzene + 4·5 parts of water + 11·2 parts of alcohol[2]) + 84·3 parts of absolute alcohol.

A last objection, however, presents itself. If there is present more benzene than is indicated in the equation, can it be easily separated from the absolute alcohol? This separation would appear, in fact, to be impossible, since the boiling points of the two bodies are extremely close. Fortunately, however, this does not matter, thanks to the very opportune existence of a binary azeotropic mixture of alcohol and benzene boiling at 68·2°C. (115°F.). A slight excess of the entraining body thus ensures the proper dehydration of the alcohol without affecting its purity. It is on this important work of the *savant* YOUNG that industrial methods of continuous dehydration depend.[3]

1 That is 100 parts of 95·5 per cent. alcohol.
2 A ternary azeotropic mixture, boiling at 64·9°C.
3 "Distillation Principles and Processes." SIDNEY YOUNG. (Macmillan & Co., London.)

Continuous Dehydration Industrially.[1]

Starting up.—Alcohol is introduced into a distillation column, *A*, of the ordinary type (Fig. 1), and distilled, returning at first all the vapour condensed. Benzene is next introduced gradually through the feed-pipe *T*, and this at once gives rise with the water and alcohol to a ternary mixture boiling at 64·9°C. Depending on the amount of benzene which has been added, thermometers arranged up the column *A* show a gradual lowering of the temperature, and addition of the entraining liquid is stopped when the thermometer t^1 placed 8 to 10 plates above the base commences to fall 2 to 3°, this indicating the presence of a few per cent. of benzene on the corresponding plates.

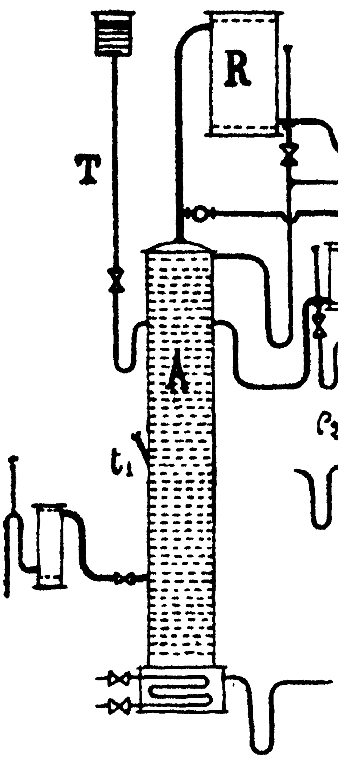

Fig. 1

Dehydration proper.—Then the column is ready for the dehydration, the benzene added being forced to work indefinitely in a closed cycle with a very low consumption. The alcohol to be dehydrated is introduced by the pipe *T*, situated in the upper part of the column at a point where the proportion of benzene is high, this being favourable to rapid dehydration. At the same time, part of the liquid condensed in the cooler *R* is sent into the decanter *D*; where it separates into two layers, the composition of which (by volume) at 15°C. is approximately represented by the following figures :—

Upper layer, 84 per cent. by volume	Water,	0·5	per cent.
	Benzene,	84·5	,,
	Alcohol,	15·0	,,
Lower layer, 16 per cent. by volume	Water,	32·0	,,
	Benzene,	11·6	,,
	Alcohol,	56·4	,,

The upper layer rich in benzene is returned to the top of the column *A* to extract a further quantity of water ; whilst the lower layer is sent to the first small column C^1, where slight heating deprives it of the little quantity of benzene it contains, it being returned to the principal column in the form of a ternary azeotropic mixture. The dilute alcohol flowing from the base of the small column c^1 is passed into a second small column c^1, which splits the liquid into water and 95·5 per cent. alcohol, this latter being returned to the principal column *A* with the feed alcohol.

In the principal column *A* the hydrated alcohol descends from plate to plate, yielding up its water little by little to the benzene, which entrains it as a

[1] *Chimie et Industrie*, 1926, 15, No. 3, 323-330; *I.S.J.*, 1926, 385.

head product. Towards the lower part of the column, one finds a zone of plates charged with anhydrous alcohol and with benzene corresponding to the binary azeotropic mixture boiling at 68·2°C. As to the pure anhydrous alcohol, this after being completely freed from benzene, is found accumulating in the base on plates situated below the thermometer t^1. It is drawn off by means of some automatic device.

Steam consumption.—Before calculating the steam consumption, it will first be necessary to point out a peculiarity of the method. Let us suppose that the column *A* is normally charged with the entraining liquid, and heated at normal pressure. Feed into it gently the alcohol to be dehydrated; the small quantity of water thus brought along will be very easily retained by the benzene on the first plates and entrained. At the top of the column a large number of the intermediary plates will thus have nothing to do towards the removal of the water, and the dehydrated alcohol will indicate strictly 100 per cent.

If now we progressively increase the feed of the alcohol to be dehydrated, a greater number of plates strongly charged with benzene will enter gradually into action. But there will arrive a moment at which (the feed still increasing) the plates containing benzene will be charged with water to the maximum. Then the concentration of the dehydrated alcohol will begin to fall, though this fall will be very slow in comparison with the increase of the feed.

This is due to the fact that the removal of the water takes place the more rapidly the greater the percentage of water, and reciprocally. It is why the last few tenths in the neighbourhood of 100 per cent. are the most difficult to reach. Thus an apparatus capable of producing up to the limit of 2500 gallons at 100 per cent. per day, starting with alcohol at 94 per cent., will be able to produce 3700 gallons of alcohol at 99·7 per cent. without any appreciable increase of steam.

In the same way, the production of an apparatus falls relatively little when one starts to dehydrate with a lower degree alcohol, for example 92 per cent., in place of 94 per cent. In a word, the expenditure of steam is not at all proportional to the quantity of water removed. One may count on a maximum expenditure of 2000 lbs. of dry steam to produce 100 gallons of alcohol at 100 per cent., starting from alcohol at 94 per cent. This steam consumption is reduced to 1350 lbs. if one is content with alcohol at 99·7 per cent., a degree sufficient in most cases. Starting from alcohol at 92 per cent., the consumption of steam is about 1600 lbs. to obtain alcohol at 99·7 per cent.

Benzene consumption.—Industrially, in place of pure benzene, it is preferable to utilize a mixture of benzene and hydrocarbons from petrol boiling within narrow limits. It is understood, of course, that the entraining liquid while indefinitely travelling through its closed cycle gives rise to a slight loss, but this always remains below 0·2 per cent. of the production of dehydrated alcohol. Contrary to what has been maintained, absolute alcohol can be obtained practically free from hydrocarbons.

TREATMENT OF IMPURE ALCOHOLS.

In the preceding we have considered only the treatment of pure alcohols. One may, therefore, ask if the process remains applicable when starting from alcohols which have not been preliminarily rectified, as certain impurities may possibly after a time concentrate in part of the apparatus, there causing some irregularity of working. Practical trials have in fact shown that in certain cases dehydration may become impossible after running a certain time. It is, however, relatively easy to avoid difficulties thus encountered. Our researches have led us to put into effect a method for the simultaneous

dehydration and purification of industrial alcohol, the purification being obtained almost free of cost by taking advantage of the heat necessary for the elimination of the water.

For convenience of explanation, the impurities habitually encountered in industrial alcohol are classed into three categories : (1) Impurities more volatile than alcohol, for example, acetic aldehyde, acetone, ethyl ester, methyl alcohol, certain fatty amines, etc. (2) Impurities less volatile than alcohol, for example propyl, butyl, isobutyl, amyl and isoamyl alcohols, heavy esters, butyrates and valerianates, products of the condensation of acetic aldehyde. acetal, furfural, etc. (3) Impurities, the volatility of which is near that of alcohol, as, for example, ethyl acetato, isopropyl alcohol, methyl ethyl acetone, etc.

First category.—After working for a certain time, these impurities collect in the head of the principal column, bringing about a slow lowering of the temperature. As they are generally very soluble in water, they accumulate mostly in the lower layer of the decanter, soon hindering dehydration if allowed to do so. But thanks to their greater volatility and to their relatively high concentration in the lower layer, it is easy to separate them by distillation in a small accessory column c^3 (Fig. 2).

Second category.—The type of impurities of this category is the higher alcohols. Advantage is taken in the complete absence of water at the base of the principal column in order to effect their separation. One knows the difficulties encounterd in ordinary rectification in freeing alcohol from tail products. It is necessary to allow for a great expenditure of calories in the rectifying column, in order laboriously to raise the concentration of the alcohol in the neighbourhood of 94 per cent., and thus to be placed in the best conditions for the separation.

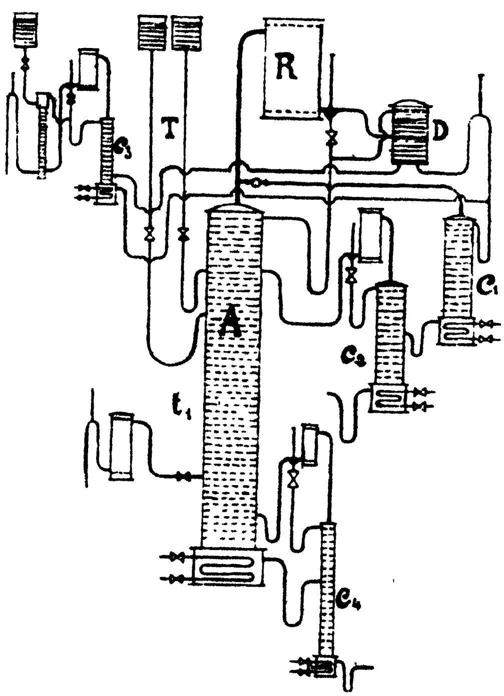

Fig. 2.

Industrially the solution is simple. In place of extracting absolute alcohol in the base of the principal column A, as ordinarily, vapour is taken from a few plates above. The less volatile products begin little by little to accumulate in the base, being removed in a very concentrated form at the foot of the small column c^4 (Fig. 2), fed by the over-flow from the principal column. These separations may appear a little complicated, but in reality the general working of the apparatus is extremely simple.

Third category.—Separation of these impurities is not always possible, but this inconvenience is limited, seeing that the impurities of this group do not generally hinder dehydration. In this category are found isopropyl alcohol and (which is much more important) ethyl acetate, this ester being

found sometimes in notable proportions in crude alcohols. It behaves in a very peculiar manner, since, owing to its slight solubility in water, it may itself be utilized as an entraining liquid. It boils at 77°C. (170°F.), and gives with water and alcohol a mixture boiling at 71·8°C. (161°F.).

Under such conditions, what happens when one dehydrates an alcohol containing ethyl acetate ? This compound at first begins to accumulate in that region of the column where the temperature corresponds to the azeotropic mixtures pointed out above. At first the absolute alcohol produced is free from ethyl acetate, but gradually the ester accumulates in the column, and the alcohol being much more difficultly freed from this product than the benzene on the lower plates of the principal column *A*, the ethyl acetate begins to be eliminated with the absolute alcohol. Its content in the ester afterwards increases until it becomes equal to that of the feed-alcohol. Dehydration may then proceed normally without any further disturbance.

It may be however, of interest to get rid of it in the course of the dehydration. One can do this by saponification by means of alkaline liquors diluted in the alcohol to be treated and introduced into the column a few plates below the feed. Their action is energetic and complete, the conditions of the medium being particularly favourable. The organic salts formed are soluble in the alcohol, and in the tail products, and they are eliminated at the base of the small accessory column c^4 (Fig. 2).

In the manufacture of ordinary rectified alcohol, one starts in every case from very dilute musts, preparing first of all crude phlegms of low and of high degree from 62 to 88 per cent., next submitting these impure alcohols to a rectification in which about 3000 lbs. of steam per 100 gallons are expended. If the manufacture of absolute alcohol direct from phlegms is contemplated, it is desirable to prepare only phlegms of high concentration, 88 to 92 per cent. This condition is very easy to fulfil, since in directly obtaining phlegms of 92 per cent. no greater expenditure of heat is demanded than in obtaining those of 88 per cent. The whole thing reduces to the addition of a few supplementary plates to the columns.

Then starting from phlegms of 92 per cent., the simultaneous rectification and dehydration of alcohol necessitates an expenditure of 1500 to 1750 lbs. of steam for obtaining a strength of 99·8 per cent. Since ordinary rectification demands on the average 3000 lbs. of steam per 100 gallons, it is seen that the advantage clearly rests in favour of the method of combined dehydration and purification. It is possible thus to produce pure dehydrated alcohol at a cost price inferior to that of ordinary alcohol.

CONCLUSIONS.

It will almost always be found advantageous in the industries to utilize anhydrous alcohol in place of 95 per cent. alcohol. Generally one does not care about what is known as the "perfect neutrality" of alcohol, excepting in the perfumery industry. Absolute alcohol as a solvent compared to ordinary alcohol is distinctly superior in almost every case, for resins in particular. It is now of considerable interest in the manufacture of varnishes and lacquers. Mixed with relatively small amounts of solvents, as ethyl acetate and acetone, it gives excellent collodions with cellulose esters, the cost price of which is particularly low. Lastly, it is to be noted that with this method of production (not its least advantage) the addition of a decanter and of a few small columns to a rectifying apparatus of the ordinary type suffices to transform it into an apparatus for the simultaneous dehydration and purification of alcohol, allowing the distiller to revert to ordinary rectification if circumstances demand it.

Economic Aspects of the Sugar Industry in Australia.

In a Report to the Department of Overseas Trade on the "Economic and Trade Conditions in Australia to August, 1929," prepared by H.M. Senior Trade Commissioner in Australia,[1] the following information is given on the economic aspects of the fiscal system in force in the sugar industry there and the working of the Government control of the sugar produced.

The development of the production of sugar in Australia to a level higher than the capacity of consumption of the Commonwealth itself has brought about the introduction of artificial price regulation. By enforcing an embargo on the introduction of sugar from countries where costs of production are much lower than those ruling in Australia, and maintaining a fixed price in Australia for home consumption supplies, it has been possible to ship at world prices the surplus sugar produced.

In July, 1915, the Commonwealth Government assumed control of the Australian sugar output, paying a certain fixed price per ton for raw sugar, and disposing of the resultant refined product at varying rates to manufacturers, wholesalers and retailers respectively.

In 1923 the financing and distribution of sugar was handed over to the Queensland Government, subject to various conditions mutually agreed. The basis of the agreement which at present exists between the Commonwealth and Queensland Governments regarding the Australian sugar industry is that, in consideration of the Commonwealth Government retaining the embargo on the importation of sugar from foreign countries, the Queensland Government shall purchase all raw cane sugar produced in Queensland and New South Wales, and shall sell the resultant refined products for home consumption in Australia to manufacturers, wholesalers, retailers and housewives at prices not greater than those fixed by the Commonwealth Government. The Queensland sugar industry must bear any losses incurred in exporting the surplus sugar, and make sugar available for use in all manufactured products exported from Australia at the Australian in-bond equivalent of the world's parity for the same class of sugar. In the latest extension of this agreement for a period of three years from 1st September, 1928, the Federal Government has reserved the right to review all home consumption prices in the event of the British or any Dominion Government deciding to alter its tariff and give further preference to Australian sugar.

As regards the sugar contents of goods exported from Australia the difference between the home consumption and export prices is adjusted by an Export Sugar Committee by means of a rebate on exports, which is calculated so as to reduce the sugar cost to the Australian equivalent of world's parity. The world's parity price, of course, fluctuates from month to month, and this correspondingly affects the monthly rebates fixed.

The Export Sugar Committee comprises one representative of the sugar industry, one member nominated by all manufacturers engaged in exporting goods containing sugar, and a representative of the Commonwealth Government.

In the 1926-27 season 81½ per cent. was delivered for home consumption and the net value of the surplus exported was £14. 18s. 10d. per ton, making an average return of £24. 10s. 10d.; in 1925-26 the average return was £19. 10s. 7d. In 1927-28 the percentage of the sugar crop retained for consumption was 68·82; the net value of the exportable surplus was £1,913,280, or £12. 11s. 1d. per ton, and the average net return for the whole crop was

1 Published by H.M. Stationery Office, London: 1930. Price 4s. 6d. net.

£22. 14s. 9d. per ton. Exports in 1925-26 were 208,805 tons, but owing to a much smaller crop in the following season, they dropped to 66,523 tons in 1926-27 ; in 1927-28 they increased again to over 150,000 tons, and in 1928-29 they have advanced still further.

The following figures regarding sugar mill production in Queensland in 1926-27, as compared with 1911, are of interest :—

	1911		1926-27
Number of factories	49	..	39
Number of employees	4,295	..	6,949
	Tons		Tons
Cane crushed	1,534,451	..	2,930,860
Sugar produced	173,296	..	457,914
Molasses—			
	Gals.		Gals.
Sold to distillers, etc.	2,393,669	..	3,301,557
Used as fodder	789,564	..	2,828,118
Used as manure	223,000	..	89,600
Run to waste or burnt[1]	1,847,333	..	7,295,155
In stock	1,197,626	..	1,172,003
Total molasses[1]	6,451,192	..	14,686,433

For the 1928 season the Queensland Registrar-General gives the following figures :—

Mills crushing	35
	Tons
Cane produced	3,736,311
Sugar produced	520,620
Molasses—	
	Gals.
Sold to distillers, etc.	5,103,471
Sold otherwise	573,350
Burnt as fuel	5,131,726
Food for stock	2,524,136
Used for manure	7,200
Held in stock	488,600
Run to waste	3,044,889

A good deal of discussion has taken place during the past year regarding the possibility of relieving the difficulties caused to the industry by over-production, and various schemes have been advanced with this end in view. Apart from the development of the acreage under sugar, it is pointed out that the quantity of cane now required for the production of one ton of cane sugar has fallen to 7·25 tons[2] as compared with an average of 9·20 tons in the ten-year period prior to 1908. This is said to be as low as that of any sugar producing country in the world. Dealing with this question in a recent issue the *Australian Sugar Journal* said :—

" Obviously by increasing the output per acre it will be possible to secure the same return from a smaller acreage, thus reducing the net cost of production. There remains still the search for a remedy for over-production, rendered critical by the fact that the increasing quantities exported and sold at the world's quite inadequate price are depriving the producers in this country, in common with those all over the world, of anything like a reasonable reward for their risks and labour, especially in view of their heavy investments of capital in land and machinery. Moreover, the figures published from time to time are leading the Australian advocates of cheap sugar at all hazards to demand concessions on the plea that if we can continue to produce sugar at

1 Quantity recorded. No record is kept of large quantities run to waste.
2 The Queensland Registrar-General gives a figure of 7·18 tons.

something like £20 a ton all round, there is no reason why the consumer in our country shall be called upon any longer to pay at the rate of something like £27 per ton wholesale.

"As was pointed out by Mr. G. H. PRITCHARD during the annual conference of the Australian Sugar Producers' Association, in January, the suggestion of limiting the quantity of sugar that could be contributed to the pool by any mill to the amount produced during the peak year of its history, would not necessarily have any immediate effect upon over-production; but it would inevitably assist in enabling consumption to overtake Australian production. What has since come to be known as the "peak year" scheme has received more support from cane growers generally than any other amongst the proposals put forward as being, from many points of view, the least objectionable form of limitation, all things considered"

At the last meeting of the Australian Sugar Producers' Association it was decided to have certain schemes for the regulation of production prepared for the consideration of the various sugar interests.

On the subject of fixation of prices a good deal of discussion has also taken place regarding a recommendation made by the Development and Migration Commission in its recent report on the canned fruit industry. This recommendation reads as follows :—

"The Commission, realising the growing dissatisfaction in the canning and jam industry based upon the feeling that this industry is contributing to an undue extent to the profits of the sugar industry, believes that an inquiry directed towards a study of the effects of the present Commonwealth sugar policy upon this and possibly upon other industries in Australia would give satisfaction and would make the position clear to all concerned. The Commission therefore recommends for the consideration of the Commonwealth Government that steps be taken accordingly."

In reply to this the *Australian Sugar Journal* stated :—

"It is constantly forgotten that the cost of producing sugar in Australia is subject to the same influences as those affecting other products, that is in the wages and conditions under which the producer is compelled by law to conduct his business. Taking everything into consideration, it is probable that whilst in some respects the sugar award calls for substantial amendments, it does not radically differ in that respect from other awards which might be quoted. Thus, as we have shown in previous years, the increase in the price of sugar is no greater in proportion, and in some commodities even less, than the increase in other necessaries of life."

Later the same journal added :—

"In this connexion we would only say at this juncture that when the embargo was first granted, the Prime Minister laid it down as a condition that those responsible for the conduct of the sugar industry should put their house in order; and we can safely claim that so far as was possible in the face of steadily declining prices for export sugar, this has been done. Queensland has given a three years' course in training overseas of three University scholars, in soils and cultivation, pathology, and technology, respectively, and these three gentlemen are now permanently attached to the Bureau of Sugar Experiment Stations, the whole cost of their special training having been borne by the industry without Government assistance. A technologist of first rank in the sugar world has been brought over from Hawaii by the Australian Sugar Producers' Association to report on measures for improving the efficiency of the mills. Also, fully qualified representatives of the milling branch

of the industry have been sent to attend the international conferences of technologists first in Cuba, and now in Java. On the cultural side the average richness of the cane has been brought up to a standard equal to anything in the sugar world, and the raising of seedling canes is being pursued with most promising results by the Bureau. The manufacture of power alcohol is established as a business proposition at Sarina, near Mackay, as a means of utilizing the molasses; and projects are being organized for the manufacture both of building board and of artificial silk yarn from the bagasse, now used only as a fuel for the mills."

A good deal of interest is still being taken in the possibility of utilizing still further the by-products of the sugar industry, and it is probable that important developments in this connexion may be seen in the near future. Meanwhile it is reported that the power alcohol plant at Sarina has been obliged to close down temporarily "partly owing to interruptions to traffic resulting from wet road conditions, and partly to the difficulty of introducing any new product."

The Sugar Industry in Jamaica—Past and Present.

Some Notes prepared for the Use of the West India Sugar Commission.

With a view to providing the West India Sugar Commission which has lately been touring the British Caribbean colonies with all possible information in regard to the sugar industry in Jamaica, a very detailed compilation was prepared and printed under the aegis of the Department of Science and Agriculture, and of the Jamaica Imperial Association. This publication consists of two sections: first a collation of the statistics of the Government Departments as prepared by the Department of Science and Agriculture under Mr. H. H. COUSINS' supervision; secondly a compilation of Answers to a Questionnaire issued by the Jamaica Imperial Association to the sugar planters, to which an explanatory memorandum has been added by the Association.

Mr. COUSINS sums up the information collated by his Department as follows:—

Development of the Industry in Jamaica.—On the conquest of Jamaica by OLIVER CROMWELL'S Expeditionary Force, sugar was found to have been started as a small industry by the Spaniards. This was steadily developed by the British settlers until, under the stimulus of the high prices for sugar during the Napoleonic wars, this product rose to a very important position in Jamaica as a tropical colony of Britain. The maximum of this period of special stimulus is to be found in the record crop of 1805 when Jamaica produced slightly more than 120,000 tons of sugar valued at £6,000,000 sterling. The record crop of rum was produced in the next year when 57,000 puncheons were exported to England.

A graphical study of the records of the sugar industry from 1805 onwards, shows, subject to seasonal fluctuations, a sharp and continuous reduction in quantities and values for both rum and sugar until the year 1840. This continuous drop was mainly due to a fall in price and to the failure of the old slave system.

By the year 1840 Jamaica's chief staples, sugar and rum, had fallen to 26,000 tons of sugar and 11,400 puncheons of rum. This year marks the ending

of the slave system, since when the sugar industry has been carried on in Jamaica with free labour and during long periods of time under less advantageous fiscal conditions than those obtaining in other West Indian countries where sugar was produced.

Sugar Production.—In 1897 the sugar exported was 14,200 tons valued at £121,000. Nearly all (95·4 per cent.) was sold in America and only 2·3 per cent. in England. This was due to the action of the United States Government in enforcing countervailing duties on Continental bounty-fed beet sugar which at that time dominated the free market of Great Britain.

As a result of the work of the West India Royal Commission, the Brussels Convention put an end to sugar bounties, while Canada offered a small but attractive preference to West Indian sugar. A few years later the Canadian Reciprocity Agreement further improved the preference for West Indian sugar in the Dominion. These circumstances, however, failed to place the sugar industry of Jamaica in a position to progress to an appreciable degree and the 1914 records only show a slight increase in quantity over those for 1897. The marked improvement in value, however, enabled the industry to pay its way. It must therefore be admitted that the good offices of the Royal Commission of 1897 and the Royal Commission on Canadian-West Indian Reciprocity of 1910 enabled Jamaica to preserve its sugar industry until the outbreak of the Great War. The profits to be made, however, under pre-war conditions were relatively small and any planter who could substitute bananas for sugar generally found it to his interest to do so despite the attractions of a favourable Canadian market for sugar.

On the outbreak of the war in 1914, Jamaica sought to assist England by a free gift of 2500 tons of sugar. The effect of the war was to encourage sugar production in Jamaica and the exports rose from 15,000 tons to 32,000 tons (in 1917). Prices rose markedly in 1919 and 1920. The crop of 1920, valued at three millions sterling, was the highest value recorded for sugar from Jamaica since the Napoleonic wars a century before.

As a result of this encouragement, large extensions in sugar manufacture and production took place. Modern factories were erected in Vere, St. Catherine, St. Mary, St. Thomas, St. Elizabeth, St. James, Trelawny, Westmoreland and Hanover. The effect of this development has been an increase of 300 per cent. in the production of sugar in Jamaica as compared with the pre-war standard. The profits of the industry, and much capital obtained from other agricultural industries than sugar, have been invested in these enterprises which, with the exception of the St. Thomas factory, have been mainly financed by local capital.

In 1921 a collapse of the sugar market seriously affected the industry. The Legislature of Jamaica passed laws to give aid by loans at the current rate of interest in 1921 and 1922. This restored the credit of the sugar manufacturers and enabled them to carry on when bank credits were unobtainable. The results of this local state-aid were completely satisfactory both to the producers as well as to the tax-payers who guaranteed the loans, and the industry was saved.

Since 1923, the restriction enforced on the Cuban output of sugar together with the preferences granted by Canada and the United Kingdom have helped Jamaica, but with the failure of the Cuban restrictive policy and in the face of a world-wide over-production of sugar both from cane and beet, the producers in Jamaica are now faced with the position that the price of sugar f.o.b.,

including the Canadian preference, is £3 less than the average cost of production.

To meet this crisis, the Legislature of Jamaica has again adopted (in December, 1929) a policy of conservation of a basal industry threatened with destruction, by granting a bounty of £2 per ton on sugar exported and arranging for an equitable distribution of the benefits arising from the limited but protected local market for grocery sugars.

Of the 13 agricultural parishes, i.e., excluding Kingston, Portland had no sugar estates in 1897. St. Andrew and Manchester have since gone out of this business and sugar estates are now found in ten parishes of the Island. In every case the production of sugar has increased in each of these ten parishes. The most remarkable increase has been in St. Catherine where sugar has increased from 1430 tons in 1897 to 13,842 tons in 1927, so as to place this parish in the lead as a sugar producer. Clarendon (including Vere) comes next with 13,311 tons as against the former output of 4664 tons of sugar in 1897. Westmoreland has increased from 5330 to 10,824 tons and St. Thomas from 1325 to 8603 tons of sugar.

To sum up: whereas Jamaica produced 20,000 tons of sugar and exported 14,218 tons in 1897, it produced 62,525 tons in 1927 and exported 49,799 tons.

Imperial Grant in aid of the Sugar Industry, 1902.—In 1902 the Imperial Government gave a free grant in aid of the sugar industry of the West Indies out of which the share allotted to Jamaica was £10,000. For the first two years the money was loaned to two sugar estates, one in St. James and one in Westmoreland. On the repayment of the capital sum after two years, it was appropriated for financing a Sugar Experiment Station by Law 45 of 1903. Of this sum £3000 was spent on laboratories and equipment and the balance was utilized at the rate of £1400 per annum for five years until the exhaustion of the grant in 1910.

As a result of this effort, a good deal of work on soils, fertilizers, cane varieties, composition and manufacture of rum and sugar factory control, was carried out and published. The high ether process for increasing the ethers in rum and fundamental data as to the production and quality of rum resulted from this effort. A demonstration of the working of the locked still system was also carried out on an estate in Clarendon. The best seedling canes then available were tested on estates: fertilizer trials were carried out on estates in every district; courses for training distillers and estate chemists were inaugurated. Since 1911 this work has been carried on as well as was possible from the funds available from the Colonial Estimates and is still in operation as a part of the work of the Department of Science and Agriculture.

Cultivation.—Great progress has been made in the use of modern methods of tillage by steam and motor power. Remarkable results have been obtained particularly in St. Catherine and in Vere by deep cultivation. In the dry areas, mulching and fly-penning are still the essentials for securing a crop.

Without adequate rains, irrigation and cultivation, the use of fertilizers is unprofitable. Where conditions are favourable for production, nitrogenous manures, particularly sulphate of ammonia, have generally been profitable. Lime has frequently been found to be highly effective in increasing the yield of canes. Potash is necessary on some soils, but phosphates on very few owing to the stores of phosphates in the soil derived from marine sources in the geological history of the Island.


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The Sugar Industry in Jamaica.

A good deal of enterprise in irrigation has been developed in Vere, St. Catherine and St. James, using streams and rivers as well as deep wells.

New Canes.—Until 1920, no seedling cane had been found that could replace the White Transparent in Jamaica. Some seedlings gave promise in the early stages, but under the hard test of estate conditions they all failed to stand up and were not useful to the industry.

In 1915 the Barbados seedlings BH(10)12 and SC(12)4 were first tested on estates in Barbados and St. Croix, followed in 1916 by Ba 11569 and by B 417 in 1922. These four canes have been found superior to the White Transparent in Jamaica and since 1920 have been steadily increasing in cultivation, BH(10)12 being the most popular.

It is considered that the West Indian cane has reached its maximum development in these seedlings and that there is not much hope of further progress. No superior seedling, subsequent to 1917, has been reported from Barbados, while Demerara has not produced a seedling in the twentieth century that has received general acceptance as superior to standard varieties. A new line of progress is now evident as based on the experience of Java. By introducing wild species of Saccharum, the Java scientists have produced new canes of which POJ 2725 and POJ 2878 are outstanding examples. It is anticipated that the crossing of POJ 2725 with the best West Indian seedlings will result in improved canes that will enable Jamaica to obtain better yields of sugar per acre due to the greater vigour and health of such hybridized plants.

Rum production.—Whereas in 1897 the production of rum was one puncheon to 1·32 tons of sugar, since the war the production of Jamaica rum has been reduced, coincident with a larger production of sugar from the cane. The ratio in 1927 was one puncheon of rum to 4·13 tons of sugar. The local consumption of rum in 1897 was 289,200 gallons with a population of 718,367. In 1928 consumption was 406,400 gallons for a population of 974,742 or almost the identical allowance of rum per head in former days. The consumption of rum by the inhabitants of Jamaica during the past 30 years has kept fairly steadily at about 2½ bottles per head per annum or one drink per person once in every twelve days of the year.

The imposition of a duty of £500 on a puncheon of Jamaica rum entering into the United Kingdom has practically killed the former trade in "Public House Rum" for which many Jamaica estates have catered for over a century. On the Continent of Europe, a demand exists for high-ether rums for blending purposes. Some estates are catering for this market and a good deal of high flavoured rum is being marketed, particularly from Northside estates, at prices that are remunerative to the producers. The Government Laboratory has given much assistance in determining the ethers in rum, so as to enable estates to standardize and guarantee this product. The local market for rum now prefers the lightest possible flavour and the larger estates have been successful in producing a popular quick-maturing rum from their re-boiled molasses, which has been a net set-off of about £1 per ton on the cost of production of sugar by the factories.

JAVA 1929 SUGAR CROP FIGURES.—According to advices from Amsterdam the final figures of the Java sugar crop of 1929 have been 2,940,748 metric tons, or 2,894,535 long tons, equal on the head sugar basis to 2,854,515 long tons.

BOOK-KEEPING MACHINES.—A. N. van der Heijde[1] describes the use and advantages of the Moon-Hopkins electrical book-keeping machine for estate accounting in Java. It is entirely automatic, and specially adapted for rapid entries on loose cards or sheets. Examples are given of the uses to which it may be put. It economizes much in labour and in time.

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1 *Archief*, 1929, **37**, No. 36, 801-815.

Diesel Locomotives for Plantation Haulage.

By W. J. KRUSE, Jr.[1]

Up to very recently Hawaiian sugar plantations have relied upon the steam locomotive for all of the major hauls; but with the invasion of the Diesel engine into the railroad transportation field it can readily be seen that the old "Iron Hoss" will have to contend for existence with equipment that is more economical and, in many ways, more suitable.

The first Diesel locomotive in the Territory, a 12-ton "Plymouth," built by the Fate-Root-Heath Company, was placed in service at Kekaha in June, 1928. This engine was received on trial and, at the end of the thirty-day period, the demonstration had been so satisfactory that the purchase price was paid without further question.

The prime mover of this locomotive is a 4-cylinder, 4-cycle Atlas Imperial Diesel engine developing 77 h.p. at 650 r.p.m. Fuel is supplied to the cylinders through injection valves and spray nozzles, and the full force-feed method of lubrication of the engine is used. The locomotive is propelled through a 14 in. diam. totally-enclosed twin disc clutch, and a transmission of over-size heat-treated alloy steel gears, arranged for four speeds ahead and four in reverse. The final drive is made by a 2 in. pitch roller-chain from the transmission drive shaft to the axles. The rugged construction throughout the locomotive makes it very suitable for plantation work.

This locomotive has been operating practically every day during the past year, and for the last few months has been working twenty-four hours daily, hauling cane during the day and doing yard work at night. The only maintenance work in connexion with the engine has been the occasional cleaning and replacing of spray nozzles, six being replaced during the year. The following report on fuel and lubricating oils for a single month's run will show the low operating cost :—

Month of February, 1929—*Twenty-four Operating Days.*

Total fuel oil used	730 galls.
Total lubrication oil used	23 galls.
Cost of fuel oil for month at \$0·05 per gallon	\$36·50
Cost of lubrication oil for month at \$0·814 per gallon	18·72
Total cost fuel and lubricant................	\$55·22
Cost per day.................. \$2·30	
Cost per ton of cane............ 0·005571	

The average day's work consisted in hauling 325 tons of cane fron the field to the mill and returning 40 tons of bagasse, 48 tons of mud and the empty cars to the field. Three trips per day, totalling 48 miles, were made.

The following figures compare the 12-ton Diesel with a 16-ton steam locomotive on a six-mile haul :—

Locomotive	Load	Time	Fuel Oil	Lubricating Oil
12-ton Diesel	175 tons	1 hr. 5 mins.	5 galls.	¼ gall.
16-ton steam	140 tons	0 hr. 55 mins.	80 galls.	⅙ gall.

The track is made up of 25 lb., 20 lb. and 16 lb. rails and is in fair condition. There is only one gradient of about 2 per cent. (1 in 50) on the plantation and the Diesel will easily handle a 50 per cent. greater load than the steam engine over it. This is due principally to being able to shift to a lower gear, 77 h.p. being applied to the load instantly and evenly through the

[1] Paper read at the eighth annual meeting of the Association of Hawaiian Sugar Technologists, October 14—18, 1929. Reproduced by permission of the Association.

transmission. As a result, the Diesel is able to start a train of loaded cane cars with greater ease than the steam locomotive.

The operating crew consists of a driver and helper, who are able to start the engine and get under way within five minutes, even on the coldest mornings. At no time has any difficulty been experienced in starting the engine. No night attendant is required.

In conclusion, it can be stated that with the Diesel there are no " boiler worries," no night attendant, no steam to hold while standing-by, and, consequently, a lower operating cost.

Automatic *pH* Recorders for Refinery Alkalinity Control.[1]

By A. L. HOLVEN.

California and Hawaiian Sugar Refining Corporation, Crockett, U.S.A.

Introduction.

During the past few years several electrodes which appear to offer fair possibilities for this work have been developed. Such electrodes have been discussed by Parker,[2] and the work of Paine, Balch and Keane[3] has indicated that both the tungsten and the quinhydrone electrodes functions satisfactorily in some types of sugar products.

As the bare-wire tungsten electrode appeared to be more promising than any of the others, it was thoroughly tested in a variety of refinery products. A peculiar characteristic indicated by these tests was that the calibration of the electrode is markedly influenced by the character of the product in which it is used. However, the fact that the calibrations of the electrode in various products are practically parallel makes it easily possible to compensate for this variable by impressing on the tungsten-calomel electrode assembly sufficient potential to place its calibration at any desired point on the recorder paper.

Experimental equipment was developed, and tried out on four refinery products, viz., raw liquor, 66° Brix, and 99° purity; affination wash syrup, 70° Brix and 80° purity, and dark and viscous; speciality liquor, 66° Brix and 99·5° purity; and Oliver filtrate from the washing of regenerated kieselguhr.

pH Recording Equipment.

The instrument used throughout this investigation was a special Leeds and Northrup recording potentiometer, having a range of —250 to + 550 millivolts. The reference electrode was the usual saturated calomel half-cell which made contact with the solution through a porous cup filled with potassium chloride solution. The bare-wire tungsten electrode acted as the indicating electrode. The electrodes were arranged in a glass flow chamber, through which the sample was passed to make contact with both tungsten, and calomel electrodes. The arrangement is illustrated in the drawing.

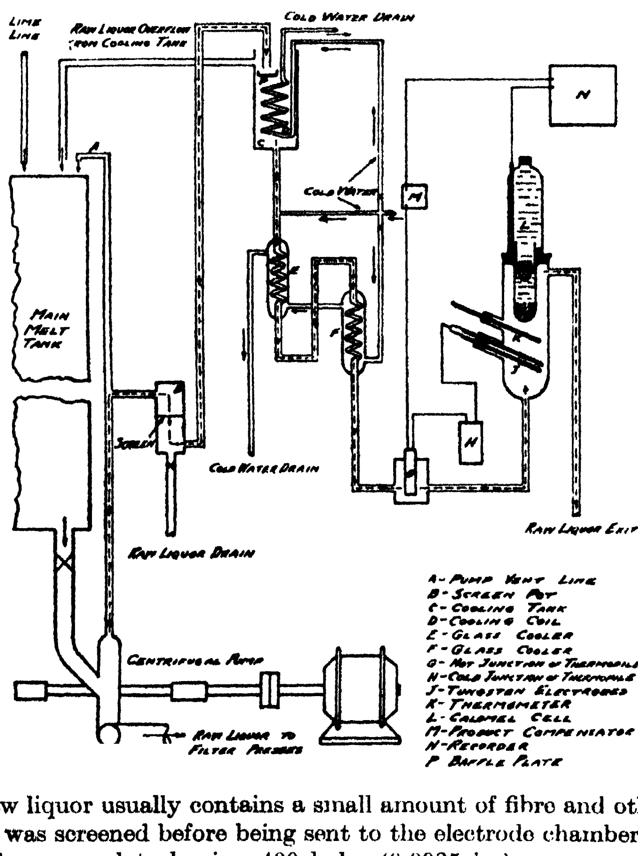
A regular routine was developed for care of the electrodes. It was necessary to flush out the calomel cell with saturated potassium chloride solution, and to renew the potassium chloride crystals and saturated solution in the porous cup every two or three days. The tungsten electrodes were found to require much more care than the calomel electrodes. In accordance with the usual practice, the electrodes were activated by soaking in a solution of tribasic sodium phosphate for about two days and were then sensitized toward the

1 *Ind. Eng. Chem.*, 1929, 21, 965-970, here abridged.
2 *Ind. Eng. Chem.*, 1925, 17, 787; 1927, 19, 660. 3 *Ibid*, 1928. 20, 348, 1148

product in which they were to be used by two days' immersion therein before being placed in service.

In operation, two tungsten electrodes were used in parallel service—one electrode being replaced each day or sooner if check determinations showed that it gave erratic readings. When a new electrode was placed in service, it was not connected to the recorder until tests showed that it properly indicated the *pH* value.

The electrodes removed from service were carefully cleaned and regenerated in the sodium phosphate solution before being returned to service. Eight electrodes were used, and a continuously rotating service was maintained. In general, the electrodes would not give satisfactory continuous service for more than one day.



As raw liquor usually contains a small amount of fibre and other foreign matter, it was screened before being sent to the electrode chamber through a perforated copper plate having 400 holes (0·0025 in.) per square inch, and cooled. But as the liquor cooled, its increased viscosity retarded flow through the apparatus. This difficulty was overcome by installing a water connexion whereby the liquor was continuously diluted to approximately 50° Brix, as previous experiments had shown that this amount of dilution had no appreciable effect on the *pH* of the liquor.

Compensation for temperature fluctuations was obtained by connecting, in series with the electrodes, a thermopile whose temperature coefficient was exactly equal but opposite to that of the tungsten electrode. As the potential of the bare-wire tungsten electrode is dependent not only on the *pH* but also on the character of the product in which it is immersed, it is necessary to

compensate for the voltage fluctuations caused by differences in compositions of the samples in order that the potentials of the tungsten electrode will give the proper readings on a chart calibrated in *pH* units.

For example, the potential of a tungsten electrode in raw liquor at any *pH* is 12 millivolts greater than that of the same tungsten electrode in No. 555 liquor at the same *pH*. A small auxiliary potentiometer and dry cell, in series with the tungsten-calomel electrode assembly, provide a simple device for securing this result. When used on No. 555 liquor for instance, the auxiliary potentiometer was so adjusted as to add 12 millivolts to the potential difference of the tungsten-calomel electrode assembly, the resulting readings thus being properly aligned on a chart originally calibrated for raw liquor. Although this device is not entirely automatic, it provides a convenient and accurate means of compensating for variations in character of the product.

RESULTS.

The results secured in the operation of the *pH* recorder on raw liquor were more promising than those obtained with any other product. A close agreement between electrometric and colorimetric results was shown by check determinations. It is evident from these results that the recorder can be read to a greater degree of accuracy than the colorimetric method now employed. However, the colorimetric method of control appears to be sufficiently accurate for the operator to maintain a close regulation of liming during normal operation of the raw melt.

Affination wash syrup in the melt house is ordinarily maintained at approximately 58° Brix at 65°C. The experimental installation was practically the same as that used for raw liquor, except that the syrup was passed directly to the cooler without screening, as it contained practically no insoluble matter. To reduce its viscosity the syrup was diluted to about 30° Brix by the direct injection of cold water. This dilution of a highly buffered product such as affination syrup causes no perceptible change in its *pH* value.

Results in Table I show the close agreement between the colorimetric and the electrometric systems of control.

TABLE I.—*pH* OF AFFINATION WASH SYRUP.

Sample	*pH* by Recorder	*pH* by Spot Test	Sample	*pH* by Recorder	*pH* by Spot Test
1	7·10	7·10	9	7·25	7·25
2	7·12	7·10	10	7·28	7·25
3	7·10	7·10	11	7·33	7·40
4	7·14	7·10	12	7·20	7·25
5	7·18	7·25	13	7·15	7·10
6	7·24	7·25	14	7·10	7·10
7	7·22	7·25	15	7·08	7·10
8	7·24	7·25	16	7·05	7·00

The *pH* of affination syrup, like that of raw liquor, can be closely regulated by the present colorimetric method of control.

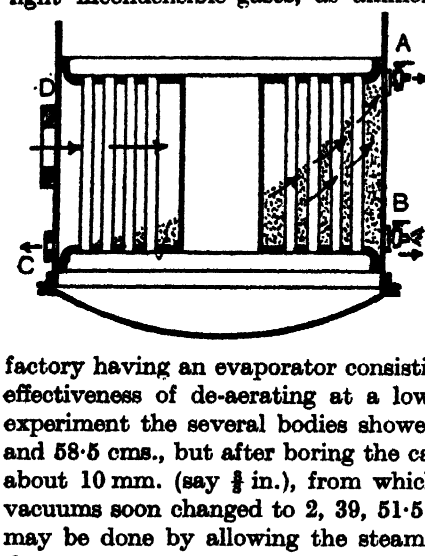
It was found that the results given by tungsten electrodes in specialty liquor were practically meaningless. Their potentials fluctuated greatly even though the *pH* of the liquor remained practically constant. The cause of this erratic behaviour has not been ascertained, but the supposition has been advanced that it may in some manner be associated with the extremely high purity of specialty liquor and its consequent lack of electrolyte and buffer substances.

It had been hoped that an automatic measurement of the *pH* of the filtrate from a regenerated kieselguhr Oliver filter would serve as a basis of

regulating the alkalinity of the sludge for the purpose of facilitating filtration. Experiments in this direction gave very disappointing results, as within a few hours after being placed in service the tungsten electrodes would become coated with a very thin film of siliceous scale, which entirely destroyed the sensitivity of the electrode. This circumstance practically eliminates the tungsten electrode or any similar type of electrode from further consideration for use in scale-forming products.

Beet Factory Technical Notes.

De-aerating Evaporators. In the German sugar industry, it has hitherto been generally customary to de-aerate the calandria of the evaporator through a vent placed high up, as at *A* in the drawing.[1] It is thus assumed that only light incondensible gases, as ammonia, are to be expelled. But actually



there are present other incondensible gases, viz., air, carbon dioxide, and sulphuretted hydrogen, all heavier than ammonia, which cannot be evacuated in this way. To the contrary, they accumulate as indicated in the drawing in the lower part of the calandria furthest from the steam inlet. On expelling the incondensible gases from a low point as at *B* in the drawing, and collecting and analysing them, it was found that 35 per cent. of CO_2 was present. In a factory having an evaporator consisting of a juice-boiler and four bodies the effectiveness of de-aerating at a low point was demonstrated. Before the experiment the several bodies showed the following vacuums : 10, 28·5, 46 and 58·5 cms., but after boring the calandria of the first body with a hole of about 10 mm. (say ⅜ in.), from which at first only cold gases escaped, the vacuums soon changed to 2, 39, 51·5 and 64 cms. De-aeration of calandria may be done by allowing the steam to blow into the open ; but a special three-way valve can be used by means of which the steam may be blown free in one position or directed into a closed pipe when turned to another angle.

Colloidal Carbonatation.—It is certain that the process of carbonatation, or "saturation" as it is termed in German literature, is not explicable merely by the equation : $CaO + CO_2 = CaCO_3$. It is not so simple a process as that. Two years ago, ATEN and VAN GINNEKEN, two Dutch investigators, began systematically to study the carbonatation of solutions of sugar containing lime, finding that not only the carbonatation, but even the mere solution of lime in sugar solutions, give rise to very complicated processes. Other observations force one to conclude that the burnt lime itself (CaO) is a colloid, which on slaking certainly also exhibits colloidal conditions. Indeed it is the colloidal nature of the dissolved CaO that explains its power of adsorption. Then it has also been shown that on titrating sugar solutions containing lime with CO_2, the $CaCO_3$ at first formed remains in solution, but that later on leading on more CO_2 a disproportionately large separation of carbonate occurs, that is, more calcium is precipitated than can be separated in the form of $CaCO_3$. Hence the precipitate contains free CaO. On carbon-

[1] Chief Engineer ECKHARDT, of Brunswick, in *Centr. Zuckerind.*, 1929, 37, No. 47 1325.

atating yet further, however, there remains in the solution more CaO than results from a smaller addition of the gas. It is only with a much greater addition of CO_2 that one can obtain the same effect as the much smaller amount. All this shows that the alkalinity does not fall proportionately to the amount of the acid added, as would be the case were HCl, for example, used for the titration, instead of CO_2. Now Dr. JAR. DEDEK tells us[1] that he has observed analogous behaviour of the limed beet juice in the factory during saturation in the carbonatation tanks. That the scums (press-cake) always contain, besides $CaCO_3$, some calcium in colloidal form combined with sugar is thus explained. Recently certain anomalies were observed by Dr. SPENGLER and BRENDEL[2] in the determination of sugar in fresh and in preserved press-cake, and these are explicable by the transformation of the basic sugar-containing precipitate into $CaCO_3$ $6H_2O$ and free CaO. Further evidence of the colloidal nature of carbonatation is to be found in the fact that in this operation it is impossible constantly to produce a precipitate having the maximum clarifying effect. Only, by further studying the conditions underlying the formation of the colloidal carbonate precipitate will it be possible at will to control the operation, in other words, to make it reproducible.

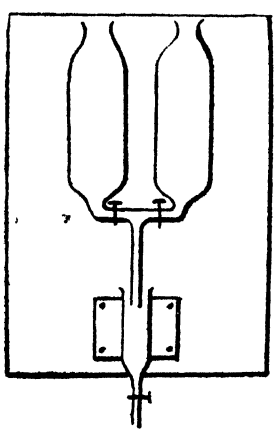
Shape of Sugar Crystals.—In discussing the factors affecting the shape of sugar crystals, R. J. BROWN, of the Research Laboratory, Great Western Sugar Co., Denver, Cal., points out:—It has been found that temperature has an indirect effect which may be of considerable influence. When the under-saturated feed comes in contact with the massecuite, a small amount of sugar is dissolved from the crystal in the under-saturated area, and the greater the degree of under-saturation, or what amounts to the same thing, the higher the massecuite temperature, the greater is the amount of sugar dissolved. This action has two effects : (1) It increases the total quantity of sugar which must be crystallized out to arrive at a definite end point ; and (2) it changes the shape of the sugar crystal so that the relation of quantity of crystal sugar to crystal surface is varied. The effect of continued dissolution and re-crystallization of sugar on the shape of the crystal may be observed by comparing the shape of the sugar crystals in rock candy and in confectioner's "A" sugar. Rock candy possesses the shape commonly associated with normal sugar, and is prepared by crystallization from a solution which is always supersaturated. Confectioner's "A" sugar tends toward flat plates and the boiling process is such that a relatively great amount of dissolution and re-crystallization occurs. When syrups containing rather large amounts of raffinose are boiled, the effect of the partial dissolution is even more striking, since in the presence of raffinose, the sugar crystals tend to take on a needle-like shape. The distortion in shape of the sugar crystal produced through the process or partial dissolution and re-crystallization in pure solutions results from the fact that sugar is not deposited on all faces of the crystal at the same rate, and the effect of differences in rates of deposition on the different faces on the crystal shape is merely magnified by this action. The fact that sugar is deposited on the different faces at various rates is readily recognized, since if this were not true the crystal would approach a spherical shape rather than the customary elongated hexagonal form.

"*Electro-Lux*" *Filter.*—Elimination of lime salts is a subject that has been much discussed lately, and in this connexion the following claims by G. DIEHN, engineer, of Schoenpriesen, Bohemia, for a filter which effects their

1 *Zeitsch. Zuckerind. Czechoslov.*, 1929, **54**, Nos. 9-10, 93-99.
2 *I.S.J.*, 1929, 381.

removal is of some interest.[1] Raw juice should be treated as ordinarily with lime, using not less than 2 per cent. of the roots, heated to 85°C., carbonatated, and filtered. Following this the stages are : filtering, re-heating, adding a further 0·25 per cent. of lime, carbonatating to 0·001 to 0·002, and filtering, re-heating to 85°C. Then the juice is passed through a decolorizing " Electro-lux " filter, 0·01 to 0·02 per cent. of active carbon (calculated on the polarization) being added to the filtrate, after which the liquid goes to the evaporators. On leaving this apparatus, the syrup is heated to 85°C., filtered, and boiled to white sugar massecuite in the vacuum pans. A sulphitation of the syrup before going into the pans would be superfluous, it is said. the liquid being so limpid and so wonderfully decolorized, far more so than could be realized by SO_2. It is further stated that the evaporators remain clean throughout the campaign. Expense is incurred, it is admitted, in the regeneration of the " Electro-lux" filter, and in the use of the active carbon ; but, on the other hand, the economy in sulphur, filter-cloths, and especially in labour is important. This " Electro-lux" filter is presumably an apparatus working on the base-exchange principle. It is claimed to remove 50 to 90 per cent. of the lime salts, no matter how combined ; and is probably the same type of filter that was recommended not long ago by the same engineer for the treatment of char-waters.[2] It would be interesting to have some certified figures for the cost of such a purification process.

Boiler Feed-Water.—In a short article FR. JANEK[3] points out the importance of carefully supervising the quality of the boiler feed-water in respect of the presence in it of sugar. It is especially desirable that it should be free of sugar, or at least almost so. In the case of boiler feed-water the sugar content will be less than it is possible to estimate by hydrometer or polarimeter. It is necessary here to apply the alpha-naphthol test, and as a ready means of so doing the apparatus shown in the sketch herewith is recommended. As may be seen, it consists of two glass vessels, one containing the alpha-naphthol and the other concentrated sulphuric acid. Below those two vessels is fixed a test-glass, in which the water under examination is placed. First the alpha-naphthol and then the concentrated sulphuric acid is allowed to drop into the sample of water without mixing the two together. If sugar is present a blue ring forms at the point of separation of the two liquids. It is advisable to mount the apparatus on a white board so that the coloured ring is easily visible.

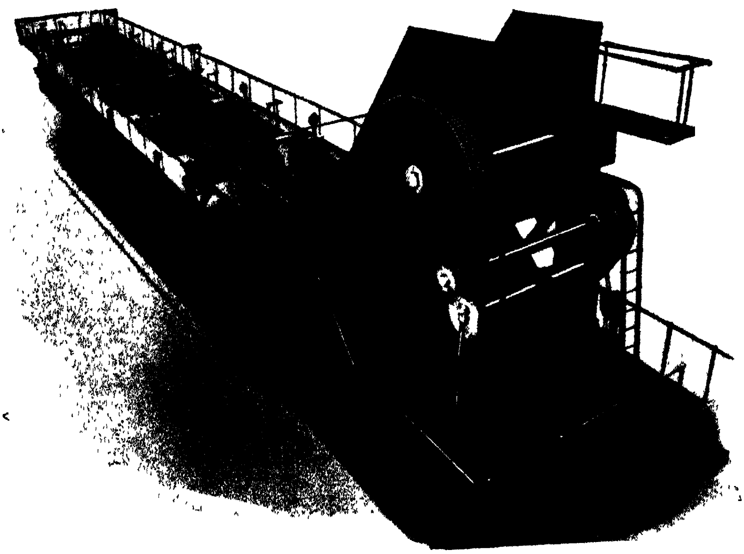


MISCELLANEOUS.

Oxalic Acid in Scale.—Oxalic acid may be present in beet factory evaporator scale to a greater or less extent, depending, according to SCHEIBLER, on the quality of the beet sliced. Laboratory experiments carried out by O. SPENGLER and S. BÖTTGER[4] now show that without doubt oxalic acid can be formed under the conditions prevailing during the process of evaporation of the thin-juice. This acid may originate partly from the glyoxylic acid contained in the beet, and partly, though to a much less extent, from the

[1] *Zeitsch. Zuckerind. Czechoslov.*, 1929, 53.
[2] *I.S.J.*, 1929, 512.
[3] *Zeitsch. Zuckerind. Czechoslov.*, 1929, 54, No. 4, 47-48.
[4] *Zeitsch. Ver. deut. Zuckerind.*, 1929, 651-667.

FARREL



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sugar itself. Since nothing is yet known of the amount of glyoxylic acid in the beet, however, it is not possible definitely to state whether in practice the oxalic acid in evaporator scale mainly owes its origin to this compound. *Sugar Destruction.*—Sugar decomposition in alkaline solution is practically independent of the *pH* value, state O. SPENGLER, F. TÖDT, and W. WINKLER.[1] On heating solutions of pure sugar rendered alkaline with soda (8·09 to 12 *pH*) at 100°C. marked variations occur, and it is possible even to observe increases of the rotatory power Investigation of the influence of sulphites studied in about 100 experiments has all shown that sulphites do not diminish the destruction of sugar by alkalis. One can probably conclude that the destruction of sugar in alkaline solution is a catalytic process, and there is evidence pointing to iron as the agent. *Lime-Milk Atomizer.*—A firm in Germany is selling a milk-of-lime atomizer with which it is claimed useful results can be obtained in beet sugar manufacture at the diffusion stage.[2] By spraying a small amount of lime (about $\frac{1}{30}$ of the usual amount added later) over the surface of the freshly washed roots before they are sliced the following advantages are obtained : injurious acidification of the juice and the greying of the exhausted slices (pulp) can be largely prevented ; extraction of the sugar is easier, due to the preservation of the natural elasticity of the slices ; slices do not become pasty or slimy on storage ; and there is a diminution of gas formation during diffusion. Many investigators in the past have advised the addition of lime in the diffusion battery for diminishing sugar inversion by acid formation, and this easy method of operating such an alkaline diffusion appears to be worth attention. *Beet Mark.*—After a review of the most important literature on the determination of the beet mark, E. THIELEPAPE and P. MEIER[3] point out the difficulties attending it Even using cold water a certain amount of the pectin passes into solution, and according to conditions of working results may vary rather much. Their method of operating was to treat the slices only for 2-3 mins. with water at 80°C., afterwards extracting with 80 per cent. alcohol for 1-2 hours. They thus obtained results varying from 3·10 to 5·81 per cent.

SACCHARIMETERS.—Adam Hilger, Ltd., state that they have discontinued the manufacture of saccharimeters. This is due to the important development of certain instruments which have been originated by them, particularly spectrographs and interferometers, novel designs of which are distinctive of this firm.

BRITISH INDUSTRIES FAIR, 1930.—The British Industries Fair, which is run annually by the Department of Overseas Trade, will be opened both in London and in Birmingham on February 17th. The catalogues which have been issued some seven weeks in advance embody a complete classification of the exhibits by trades and indexes in nine languages. This Fair continues to grow in importance, and the available space at Olympia is as a rule booked a considerable time in advance.

REFINING AT GREENOCK.—Great expansion of British sugar refining, due to the fiscal changes contained in the Budget of 1928, has taken place during the past 18 months, says the *Glasgow Herald*, and in this the Clyde refining trade has participated, its output for 1929 being estimated at 165,780 tons, as against 111,284 tons in 1928, and 101,274 tons in 1927. In the month of August, the Glebe refinery, which had been silent for some years, re-opened its doors, so that three refineries are now at work in Greenock. To the output of these refineries, there has to be added the cane sugar refined at the Cupar home-grown beet factory. The Scottish market is thus very fully supplied, and the quantity of refined sugar coming from foreign countries is now very small.

1 *Zeitsch. Ver. deut. Zuckerind.*, 1929, 668-679.
2 *Centr. Zuckerind.*, 1929, 37, No. 44, 1243.
3 *Zeitsch. Ver. deut. Zuckerind*, 1929, 79, 539.

Publications Received.

A Handbook for Cane Sugar Manufacturers and their Chemists. By the late Guilford L. Spencer, D.Sc. Seventh edition revised, re-written and enlarged by George P. Meade, B.S. (Chapman & Hall, Ltd., London). 1929. Price : 30s.

The first edition of the late G. L. Spencer's "Handbook" was published as far back as 1889, and was a meagre volume containing "practical instruction in sugar-house control, selected methods of analysis, reference tables, etc." It dealt solely with chemical analysis and control methods. As each succeeding edition was published, the scope of the book was widened. In the fourth, for example, a brief description of the manufacturing methods used in raw sugar manufacture was first added, Dr. Spencer recognising that "the proper control of a sugar factory by the chemist requires a knowledge of the methods of manufacture." This was again enlarged in the fifth, when a chapter on refining was also added. Now in its seventh edition, which has just appeared, the book has been much further expanded. Its first 15 chapters, in fact, comprise a small textbook on the manufacture and refining of sugar, the closely printed 190 pages covering this part of the book being filled with useful information, suitably illustrated, and well up-to-date.

This work of revision has been undertaken by Mr. Geo. P Meade, Manager, Gramercy Refinery, Louisiana, who has added chapters on : Economic Phases of the Sugar Industry; Keeping and Refining Qualities of Raw Sugars; Hydrogen Ion Control; and Colour Determination in the Sugar Industry. He has also expanded the chapter on Refining. There now appears an excellent chapter on Evaporation and Juice Heating by Prof. W. H. P. Creighton, and another new feature is Dr. Owen's contribution on Fermentation and Micro-organisms, treating of mill sanitation. Turning to the main part of the book, that dealing with sugar analysis and chemical control, which consists of 23 chapters, this remains essentially as in the last edition, though useful additions have been made, the principal being data on : the Eynon and Lane method of determining reducing sugars, conductimetric ash methods, colorimetric and electrometric *pH* determinations, the Tint-photometer and K. & E. colour analyser, purchase of cane in different countries, and the analysis of flue gases. It is seen therefore that the work of revision has been an extensive one. It has been done throughout with painstaking care to ensure clearness and accuracy. Spencer's "Handbook" has long been considered a reliable guide for the chemist. It cannot be doubted that this high reputation so well established by its late author will be maintained in this its latest edition revised by Mr. Meade.

Diatomaceous Earth. By Robert Calvert. American Chemical Society; Monograph Series. (The Chemical Catalogue Co., Inc., New York). 1930. Price : $5.

This is a general Monograph on diatomaceous earth or kieselguhr, the occurrence, mining, physical properties and commercial uses of which it describes in 16 chapters. We are told that altogether the sugar industry represents the largest user of it to-day. Its application has become almost universal in the cane sugar refineries of the U.S.; it is used to a less extent in cane and beet factories, for the making of corn products, and for clearing molasses when making yeast. These applications are described and some flow-sheets shown in illustration. Of great significance are the data on the advantages in filtration of calcined versus natural diatomaceous earth, grades of which have recently been introduced as "Standard Supercel" and "Hyflo Supercel." A graph shows the considerable increase in the rate of flow that is obtained when using "Hyflo," at least four times that found with the untreated product, i.e., "Filter-cel." "Standard Supercel" is intermediate in its properties. Those interested in filtration problems will find much data to interest them in this book. It forms a very useful and well-written Monograph on the subject.

The Louisiana Sugar Manual. By A. B. Gilmore. (615, Godchaux Building, New Orleans). $5.

This manual, in its 22nd annual edition, gives an inventory of equipment of the various Louisiana sugar mills, being on the same lines as the author's larger and more recent Cuban Sugar Manual.

Brevities.

Sugar Machinery and India.—Importations into India of sugar machinery during 1928-29 and 1929-30 in Rs. (Lakhs) were 15 and 4¼, according to a recently published Survey of the Import Trade in India,[1] the large decline being of course due to the fact that during the 1929-30 period no new factories were erected.

New Companies.—Among new companies recently registered in the U.K. are: General Sugar Traders, Ltd., 21, Mincing Lane, E.C.3. (243,938). Private. Nominal capital, £10,000. Liverpool Sugar Exchange, Ltd., India Buildings, Liverpool. (244,515) Public. Nominal capital, £1,250. J. B. Crispin, 15, Exchange Buildings, Liverpool (Director).

Cleaning Glassware.[2]—The standard bichromate "cleaning mixture" of the analytical laboratory has long since deserved to be displaced. It is dangerous, destructive, and inefficient. Trisodium phosphate as a possible laboratory detergent has been investigated exhaustively and has much to recommend it. A 15 per cent. solution, heated to about 70°C., can be used for cleaning burettes and other volumetric glassware with very satisfactory results.

Original Home of the Cane.—Dr. H. C. Prinsen Geerligs[3] says that all the 175 varieties of cane collected by the New Guinea Expedition were obtained from native gardens. None was discovered growing in a wild state. A large grass growing abundantly in a wild state, *Saccharum robustum*, was found to contain no sugar. It may be found useful in breeding. Another variety containing no sugar is *Saccharum spontaneum*, though it appears to be an ancestor of POJ 2878.

Oliver Continuous Filters.—Central Leao, Alagoas, Brazil, has an installation of Oliver-United drum type, continuous vacuum filters for the *cachaza* (mud) from the continuous clarifiers. There are two filters, each approximately 110 sq. ft. of surface, the capacity of the factory being 1250 metric tons of cane in 24 hours. An average of the sucrose in the cake discharged from these filters is 1·25 per cent. (of the wet cake). Perforated plate is used as medium, in place of filter-cloths, and this is expected to last for some seasons without any attention.

pH Standards.—W. A. Taylor[4] writes against the use of glass colour standards for *pH* work, stating that the standards obtained by means of buffer solutions have distinct advantages. They are more accurate; it is impossible to match the delicate tints given by the various indicators; and it is doubtful whether coloured glass is really more permanent than properly prepared standard solutions. Buffer standards are in general much more satisfactory, and when protected from excessive exposure to light and heat they are stable for a period of 4-5 years After all, glasses and colour charts are only imitations, whereas buffer solutions are the master standards.

Research Pays.—Mr. H. Atherton Lee, Research Director, Philippine Sugar Association. recently stated that with a budget of only $37,500 he calculated that results had been obtained by the Association representing an actual accrued value to the sugar industry of more than $1,500,000. For example, the discovery that some districts required phosphoric acid as fertilizer, while others needed nitrogen alone had resulted in enormous savings. Some 2000 acres of refractory soils had yielded to a treatment with potash, supplemented by bagasse ash and filter-press mud. Further, in many districts the Research Bureau had been able to increase yields over 75 per cent.

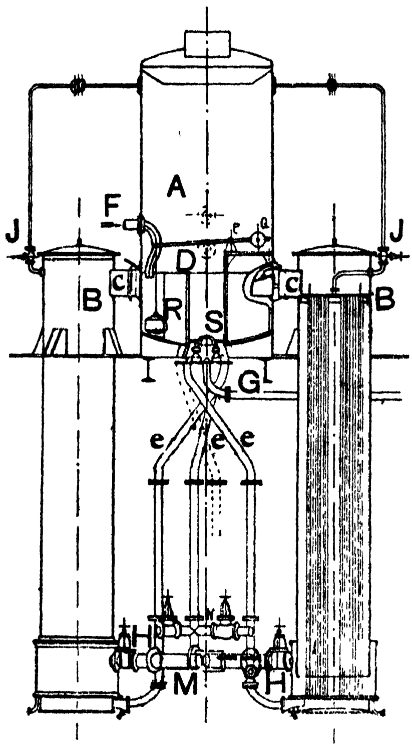
Mixed Fertilizer.—A Norwegian chemist, Erling Johnson, has applied for a patent, the novel feature being the application of strong nitric in place of sulphuric acid for the decomposition of raw phosphate. By maintaining suitable conditions of concentration and temperature, it is possible to separate the major portion of the lime content, in the form of calcium nitrate by crystallization from the obtained solution. The resulting mother-liquor, containing all the phosphoric acid and part of the calcium nitrate, is neutralized with ammonia, and a mixed fertilizer is obtained on evaporation and drying. Or, the first solution may be neutralized and worked to a mixed fertilizer without first separating part of the calcium nitrate.

1 *Ref. No. C*, 3167, December, 1929.
2 E. A. Vuilleumier, in *Ind. & Eng. Chem.* (News Edition), 1927, 7, No. 23, 3.
3 *De Indische Mercuur*, December 4th, 1929.
4 *Ind. & Eng. Chem.* (News Edition), 1929, 7, No. 24, 12-13.

Review of Current Technical Literature.[1]

THE VINCEK-TUREK EVAPORATOR. **G. W. Grazlansky.** *Die deutsche Zuckerindustrie*, 1929, 54, No. 33, 896-897.

In the sugar industry many and various systems of evaporators have hitherto been employed. Practice, however, has shown that the vertical ROBERT, the KESTNER, and the sectional VINCEK-TUREK types are the principal ones to survive. Indeed, only these need be considered. The Vincek-Turek apparatus consists of a central vessel *A* around which any desired number of heating bodies B_1, B_2, etc. can be grouped, each with its appropriate heating surface. For example, in apparatus of 1200 sq. m. (13,000 sq. ft.) of heating surface, four bodies having 300 sq. m. (3250 sq. ft.), or six having 200 sq. m. (2160 sq. ft.) are provided. The upper part of each heating body is connected by means of a pipe containing a valve *C* to the central vessel *A*. In this latter are partitions *D* dividing its interior into several compartments. In these the vapour is separated from the juice, their number being equal to the number of heating bodies plus one. In the first of them is a float *R* actuating the outlet valve *S*. If the juice inflow is interrupted, or if there is insufficient juice in the evaporator, this valve remains closed; and the juice circulates in the apparatus without leaving the same. But so soon as sufficient juice has entered the apparatus, the float *R* opens the valve *S* and the necessary amount of juice flows out of the apparatus. In the lowest part of each compartment of the central vessel *A* is placed a tube *E* through which the juice flows. The method of operating the appraatus is as follows: Juice which has entered the first compartment of the central vessel *A* by means of the tube *F* flows through the tube *E* (valves *M* and *N* being normally adjusted) into the lower part of the heating body *B*, rises up through its heating tubes, and flows over *C* into the second compartment of the central vessel *A*. From this it goes by way of the tube *E* into the second heating body *B* and so on until it leaves the apparatus through the tube *G*. By suitably manipulating the valve at the connexion *C*, and also the valves *M* and *N* any heating body can if desired be cut out. Heating steam enters the heating body *B* through the valve *H*, whilst tubes *J*, *J* are for withdrawing the ammoniacal gases. In such a design the heating of the tubes is very regular, due to the small diameter of this body, viz., 500 to 1000 mm. ($19\frac{3}{4}$-$39\frac{1}{2}$ in.). Moreover, in case of need, it is possible to feed steam of different pressures to any single heating chamber. Separation of juice and vapour is completely effected in the central vessel *A*, entrainment being precluded. Caramelization is also prevented. This apparatus is more convenient to transport and to erect than the ordinary vertical type.



FUEL CONSUMPTION IN MAURITIUS SUGAR FACTORIES. **L. J. Coutanceau.** *La Revue Agricole (Maurice)*, 1929, No. 47, 173-189.

With induced draft, such as is common practice, bagasse burning furnaces work with an excess of air which can be said to vary between the limits of 67 per cent. and 100 per cent., not taking into account such badly designed furnaces as require

1 This Review is copyright, and no part of it may be reproduced without permission.—Editors, *I.S.J.*

more than 100 per cent. excess air. It is assumed that feed-water heaters are only two-thirds of the capacity advocated by the makers, i.e., 0·25 sq. ft. instead of 0·352 sq. ft. per kg. of feed water. On these assumptions, two graphs have been drawn for the average Mauritius plant, for 67 per cent. excess (good furnaces) and 100 per cent. air excess (ordinary furnaces). An analysis of these shows that, when working with a good furnace (67 per cent. excess air) and no boiler overload, 1 kg. of bagasse will produce 2·7 kg. of steam per hour. However, in many factories, when required to produce white sugar, the boilers are found to be overloaded some 20 per cent., on a conservative average. In the circumstances, the boilers will produce 2·572 kg. of steam per kg. of bagasse per hour. As the average weight of bagasse is about 245 kg. per ton of cane, we find that with no overload the boilers will produce 660 kgs. of steam per ton cane hour, whereas with 20 per cent. overload the boilers will only produce 630 kgs. of steam per ton cane hour. The author has shown that for the manufacture of high grade white sugar, the steam consumption of a well equipped factory is in the neighbourhood of 750 kgs. of steam per ton cane hour; and for manufacturing raw sugar at 96° polarization, about 615 kgs. only per ton cane hour, being a saving of about 18 per cent. as compared with white sugar manufacture. Market conditions have, however, brought about the necessity of producing raw sugar at a polarization approaching as near as possible 99°, but the saving in steam for 99° polarization raw sugar is only 12 per cent. in comparison with high-grade white sugar manufacture. On this basis, the steam consumption would be reduced to about 660 kgs. per ton cane hour, and the overload of the steam producing plant under investigation will be reduced to about 100 per cent. instead of the 20 per cent. above mentioned. Consulting the graphs, ones find that in the particular circumstances now under consideration, the evaporative power of 1 kg. of bagasse per hour is 2·64 kgs., i.e., 650 kgs. of steam per ton cane hour. Considering that most factories cannot be confined to the exclusive manufacture of raw sugar, but must also produce a certain proportion of white sugar, it follows that only such factories as crush canes containing more than 12½ per cent. fibre, or whose furnaces work with less than 67 per cent. excess of air, and whose boilers are not overloaded can hope to dispense with extra fuel. Addition of air-preheaters besides economizers to the boiler plants would be a great improvement, and provide an abundant supply of steam for the manufacture of the so-called raw sugar. It would not, however, except in exceptional circumstances, meet the demands of a factory manufacturing high grade white sugar. Following this the author calculates that if economizers were discarded altogether, and air pre-heaters only were used, the position would be quite a different one. Thus with 85 per cent. efficiency, feed-water at 107°C., and 67 per cent. of air, 1 kg. of bagasse will evaporate 3·3 kgs. of water per hour and produce about 810 kgs. of steam per ton cane hour—and, even with 100 per cent. excess of air, the steam production is about 760 kgs. per ton cane hour or more than necessary for the manufacture of very high grade white sugar. Assuming for an average furnace a mean figure of 785 kgs. of steam per ton cane hour at normal rating, it is found that there will be surpluses of 8 kgs. and 40 kgs. of bagasse for the manufacture of high grade white sugar and 99° polarization raw sugar, respectively. For an average factory, working 20 hours daily and crushing 33 tons of cane per hour, the amount of surplus bagasse will be over 5 tons for high grade white sugar and about 26 tons for 99° polarization raw sugar per day. An exceedingly important consideration will be the necessity or not of closed hot-wells and their proper arrangement. It must be clearly understood that the advantages above indicated can only be obtained with plants that have been well proportioned and not merely laid down in a haphazard way.

VACUUM PANS AT HONOLULU PLANTATION, T.H. **Walter E. Smith.** *Reports of the Association of Hawaiian Sugar Technologists*, 1929, 79-81.

Four new pans installed at this factory are interesting from the standpoints of design and heat economy. The calandrias of the commercial sugar and low grade pans have copper bearing steel flat tube sheets, the calandria section being welded throughout, thus eliminating the possibility of the leaks at the joints between tube sheets and centre well. The tube sheets of the white sugar pan are of bronze. The

centre well is extended for a considerable distance below the lower tube sheet, thus ensuring active circulation in the lower cone. There has been no difficulty in making a finished sugar of satisfactory grain, well above the usual standard of "25 per cent. total small grain." The volume of massecuite to the top of the calandria, or the so-called "graining volume," is 37 per cent. of the working capacity for the 12 ft. pans and 29 per cent. for the low grade pan. The heating surface of the 12 ft. pans consists of 648 four-inch outside diameter tubes, giving a total surface of 2276 sq. ft. The volumetric capacity of these pans is 1200 cub. ft., measured to 4 in. below the top of the main belt. This gives a ratio of 1·9 sq. ft. of h.s. per cub. ft. of working capacity. The low grade pan is 13 ft. in diam., and has a h.s. of 2662 sq. ft., with a working capacity of 1800 cub. ft., giving a ratio of 1·48 to 1·0. The calandrias are of the baffled type, with a single inlet for steam. The baffles produce a positive flow of steam throughout the calandria, and also provide a definite point for the evacuation of non-condensible gases. The two air vents are connected to a common pipe, which discharges to the vapour space; a thermometer is installed between the air vent connexion and the control valve, and from the temperature indicated it is possible to measure the effectiveness of the venting. For example, with a pressure of 3 lbs. on the calandria, corresponding to a temperature of 220°, the thermometer would register 220° if the air vents were discharging vapour without any measureable quantity of collected gases. The commercial sugar pans and the low grade pans operate entirely on vapour from a special pre-evaporator. With the exhaust steam pressure at 6 to 8 lbs., the vapour pressure available for the pans is from 3 to 5 lbs., which is ample for all requirements. At this pressure it is possible to start a pan and boil a full strike of grain in four hours or less; after a cut, a pan may be finished, and boiled to proper density for purging in about four hours with a maximum pressure of 4 lbs. The average vapour consumption for all pans, based on performance over a 24-hour period, is from 30,000 to 35,000 lbs. per hour. This represents a reduction in evaporation at the quadruple effect of an equal amount, and since this is only single effect evaporation, it is equivalent to a saving of from 7500 to 8750 lbs. of exhaust steam which would be required to evaporate the same quantity of water at the evaporators proper, representing a saving of from 1·5 to 2 barrels of oil per hour. With the large heating surfaces available, it follows that the actual evaporation per square foot of heating surface will be lower than is the case when higher steam pressures are used. For the commercial sugar and low grade pans the duty is approximately 5 lbs. of evaporation per square foot per hour. The white sugar pan usually operates on exhaust steam, though during the early stages of the strike it is possible to use vapour for concentration of the initial charge. Steam flow measurements show that with a pressure of 10 lbs. on the calandria of the white sugar pan the steam consumption may go to 25,000 lbs. per hour, which is equal to 12 lbs. per square foot per hour. With both commercial sugar and low grade pans there is no difficulty in securing a very satisfactory grain, free from any more than the usual amount of "conglomerate"; at 4 lbs. pressure the pans may be boiled to a satisfactory density and during the earlier stages a pressure of 1 to 2 lbs. will give a very vigorous circulation. There is absolutely no difficulty from massecuite lodging on the tube sheet, even when the strike is boiled to high density.

REGENERATING "CARBORAFFIN." **Stan. Makulik.** *Deut. Zuckerind.*, 1929, **54**, 875. At Gross Düngen factory, Germany, "Carboraffin" regenerated by the following steps was found to decolorize and filter well, the make-up of fresh carbon being 10-15 per cent.: washed with hot dilute HCl; filter-pressed; and washed to slight acidity; compressed to briquettes; dried in hot air, the temperature of which was raised till the lower layers were ignited; admitted steam and decreased air to give a temperature of 500-600 °C., and this maintained till all adsorbed organic impurities are burnt, leaving the "Carboraffin" little affected. Per 100 kg. of "Carboraffin," HCl required 4-8 kg.; steam, 1 ton; and power, about 25 k.w.h. for briquetting and air compressing.—LIQUID FUEL (OIL) TEST-CODE. *Mechanical Engineering*, 1929, **51**, No. 12, 958-960. A draft test-code of the American Society of Mechanical Engineers includes information on analysis and tests, including instructions for

determining calorific value, gravity, carbon and hydrogen content, sulphur, ash, water and sediment, viscosity, distillation range, flash and fire points, cloud and pour points, colour, corrosion, acidity, burning quality in wick burner, quantity, etc. Copies of the code in full can be obtained from the Committee on Power Test Codes, care of the Society.—PRECAUTIONS IN MAKING WHITE SUGAR. **L. Pitot.** *Revue Agricole (Mauritius)*, 1929, No. 46. SCHNELLER showed that the dark tinge of plantation white sugars is due to traces of phenol-iron compounds, and that the only practical means of preventing their effect is the reduction of the coloured ferric to the colourless ferrous compounds by suitable reducing agents. Recommendations here made are : using hydrosulphite at the moment of graining if the sulphitation of syrups and thick-juices is not possible ; avoiding the entrance of air in the mixers by using closed apparatus under vacuum ; and adding sulphurous acid to the massecuite. Coating the iron surfaces with a rust-proof paint or enamel is also important ; and one should also avoid grinding white cane tops, these being particularly rich in tannins and polyphenols.—SUGAR-PRODUCING PLANTS. *International Review of Agriculture*, 1929, **20**, No. 10 (Monthly Bulletin), 393-396. Among sugar-yielding plants, other than cane and beet, maple and palms, capable of large-scale cultivation, which are or may possibly become of importance are the following : carob (20 to 25 per cent. of sucrose) ; maple ; manna (the sap of which contains mannose, sucrose, dextrose and levulose) ; millets (16 per cent. of sugar) ; artichoke ; melons and pumpkins. The anonymous writer says that the mixture of sugars prepared by treating inulin with an acid by which 92 per cent. of fructose and 8 per cent. of fructose anhydride are obtained may enter into competition with sucrose in the future.—MECHANICAL ANALYSIS OF SOILS. *Agricultural Progress*, **5**, 1-8. Essentials of the new official method to replace the older sedimentation method of 1906 consists in (*a*) the use of hydrogen peroxide to destroy organic matter, and thus aid the dispersion of the soil ; and (*b*) a shorter procedure to obtain the percentages of the fractions, depending on the measurement by pipette sampling of the depth concentration relationship in a settling suspension. Both improvements were introduced by ROBINSON[1] and were thoroughly examined by a Committee of the Agricultural Education Association, including Dr. BERNARD DYER and Dr. B. A. KEEN (Assistant Director, Rothamsted Experimental Station).—BOILER WATER COMPOSITION. *Daily Telegraph* (Engineering Section), *December 2nd*, 1929. Dependence of the quality of the feed water on the operation of the boiler is now recognized to be even greater than was formerly supposed. The increased temperatures accompanying increased pressures lead to the decomposition of any traces of chlorides, and this liberates hydrochloric acid, which attacks the metal at an accelerated rate at the higher temperature. In fact it is considered that to-day even more depends upon the operation of the boiler than upon the thickness of its metal and its constructional features, these latter being so well cared for in modern designs. De-aeration, too, has received considerable attention, as the three main constituents of air, oxygen, nitrogen, and carbonic acid gas, each has some detrimental effect, nitrogen causing embrittlement, while the others promote corrosion.—COLLOIDS OF BEET MOLASSES. **A. von Brodovski.** *Kolloid-chem. Beih.*, 1929, **29**, 261-353 ; through *J. S. Chem. Ind.*, 1929, **48**, No. 51, 1026-1027. The surface tension of beet molasses solutions falls with increasing concentration, passes through a minimum, and thereafter rises. The relative viscosity is lower than that of a sucrose solution of the same concentration and alteration of the H.I.C. has little effect. Colloid content amounts to 1·07 per cent., and is divided into reversible or irreversible, which latter forms the greater part. Some of it behaves amphoterically. About 25 per cent. of the reversible consists of araban. It was not possible to identify albumins, probably because they may have suffered degradation during the manufacturing process. Colouring matter is in the irreversible colloidal part.—DETERMINATION OF REDUCING SUGARS. **R. Ofner.** *Zeitsch. Zuckerind. Czechoslov.*, 1929, **53**, 728-733. Previous work is continued.[2] A method is now described in which the solution of reducing sugars is boiled with a solution containing 5 grms. of cupric sulphate, 10 grms. sodium carbonate, anhydrous, 300 grms. of Seignette salt, and 50 grms. of sodium diphosphate

[1] *J. Agric. Science*, **12**, 287. [2] *I.S.J.*, 1928, 103.

together with a teaspoonful of kieselguhr or activated carbon per litre. After cooling a solution containing iodide, some dilute acid, and a slight excess of N/50 thiosulphate are added, the liquid lastly being titrated with N/50 iodine. This new copper reagent is said to have very little effect on the sucrose which may be present with the reducing sugars.—REDUCING SUBSTANCES WHICH ARE NOT REDUCING SUGARS. **Marie Herlesova.** *Zeitsch. Zuckerind. Czechoslov.*, 1929, **53**, No. 52, 749-754. *In this study proof is brought forward that on heating slightly alkaline solutions of sugar, reducing substances which are not identical with reducing sugar are formed.* They accumulate in the syrups and molasses. Only half to two-thirds is precipitated by the usual clarifying agents (HERLES' solution being the most effective). This explains why in alkaline molasses a higher cupric reduction is found than corresponds to the sucrose present, leading one erroneously to conclude that reducing sugars are present, though there is no possibility of their existence in such alkaline-reacting product.—MECHANICAL "TEST-SIEVES." *Communicated by the Manufacturers to the I.S.J.* Instead of leaving sieving to the care of the laboratory boy, the modern method is to employ a sieving machine by means of which the material is shaken for a certain time always in the same way. Hand-sieving actually is inaccurate and tedious, and it does not always give the same result on the same material in duplicate or triplicate determinations. An apparatus known as the "Test-sieve" has recently been put on the market, which accomplishes its work with accuracy; it saves time, and requires no attention, there being a time switch by means of which the machine is stopped at the end of any predetermined time. These machines are said to save a great amount of time in laboratories where much sieving is to be performed, but the chief feature of their usefulness is that they give comparable tests, conditions being always alike.—ELECTRODIALYTIC REMOVAL OF SALTS FROM SUGAR SOLUTIONS. **S. Zieminski.** *Przemysl Chem.*, 1929, **13**, 429-445; through *British Chemical Abstracts*, 1929, **906**. Solutions containing 15 per cent. of sucrose and 1 per cent. of sodium or potassium chloride or carbonate were electrodialysed in a PAULI apparatus using graphite electrodes. Using a current of 1 amp. at 200 volts half of the salt content could be removed in 8 min. only ½ per cent. remaining after 90 min. The sucrose concentration remained unaffected. In the case of beet juice, platinum electrodes had to be used, and using any stronger current than 0·18 amps. at 100 volts the liquid foamed to an extent sufficient to arrest the process.—THE MILLILITRE. **V. Stott.**[1] *Nature*, October 19th, 1929. When volumes are derived from measurements of length, it is appropriate that they should be expressed in terms of cubes of the units of length, but when volumes are obtained from weighings the litre is the obvious unit. It is unfortunate that the litre and the cubic decimetre are not exactly of the same volume, though their difference is so slight as to count only in accurate work. An additional source of confusion was introduce by MOHR in 1868 when for the calibration of volumetric glassware he called by the name of a cubic centimetre the volume occupied at 17·5°C. by the mass of water having an apparent weight in air of 1 grm. In 1924 the Joint Committee for the Standardization of Scientific Glassware recommended :—"that the recognised international metric units—the "litre" and "millilitre" or thousandth part of litre (ml)—shall be used as the standard units of volume, and that standard volumetric glassware shall be graduated in terms of these units and marked "ml" instead of "c.c."—ORGANIC ACIDS OF CANE MOLASSES. **E. K. Nelson.** *Jl. Amer. Chem. Soc.* 1929, **51**, 2808. Cane molasses was found to contain : formic acid, 0·1 ; acetic acid, 0·2 ; aconitic acid, 0·8 ; and lactic acid, 00·5. Small quantities of malic and citric acids were also present, the latter not having been previously stated as a constituent of cane molasses.—USE OF HYDROSULPHITE IN THE PAN. **C. Grossi.** *Industria Saccharifera Italiana*, 1929, **22**, No. 9, 489-494. Sodium hydrosulphite (an Italian product having the trade-name "Albite") was added to the pan at the rate of about 3·4 grms. per ton of massecuite, this addition being made in the form of the dry material, not as solution. A decolorization averaging 13 per cent. was obtained, and this is said to have remained permanent for more than an hour even after passing air through it.

J.P.O.

[1] Of the National Physical Laboratory, Teddington, England.

Review of Recent Patents.[1]

UNITED KINGDOM.

CONFECTIONERY. (*A*) **C. B. K. Boggild and M. Jacobsen,** of Copenhagen. 320,546. November 8th, 1928. (*B*) **A. Parusel,** of Gross-Strehilitz, Germany. 321,012. September 17th, 1928. (*C*) **E. M. Pommier,** of Chiswick, London. 321,641. August 9th, 1928. (*D*) **T. & T. Vicars, Ltd.,** and **E. M. Crosland,** of Earlestown, Lancs. 321,403. May 3rd, 1928. (*E*) **T. & T. Vicars, Ltd., and E. M. Crosland,** of Earlestown, Lancs. 321,414. May 3rd, 1928. (*F*) **R. F. Macfarlane, W. E. Prescott, and Baker Perkins, Ltd.,** of Willesden, London. 321,383. October 23rd, 1928.

(*A*) A machine for moulding hollow articles, particularly chocolate Easter eggs, comprises an endless belt which is equipped with moulds adapted to be rotated in two planes during the solidifying period. (*B*) Hollow bodies, e.g. Easter eggs, etc. are produced from marchpane by applying a thin layer of the material to the mould halves and backing it with a strengthening layer of chocolate, cocoa-butter, etc. painted thereon. The two halves of the article are united by confectionery material or by ribbon, etc., and may be ornamented externally with chocolate, etc. The articles may be filled. (*C*) Confections such as chocolate are made by treating whole sugar with a vegetable decolorizing carbon to remove objectionable colour, odour and taste, mixing the treated syrup with a flavouring substance such as cocoa beans, evaporating the mixture to a substantially solid mass, and grinding this mass to a substantially homogeneous condition. The raw cane sugar is dissolved or melted in water and to the solution is added 2·5 to 4 per cent. by weight of the vegetable carbon. The mixture is filtered and yields a cane sugar syrup containing the invert and non-crystallizable sugars of the raw sugar cane. Roasted cocoa beans, preferably an equal weight are added to and mixed with the sugar syrup and the mixture evaporated, the resulting mass being subjected to grinding operations and finally cast in moulds. (*D*) Relates to apparatus for sheeting plastic confectionery material and more particularly for spreading jam, cream or the like on to wafer, cakes, or other foodstuff. (*E*) This specification concerns apparatus for sheeting dough or applying a sheet of coating material to biscuits. (*F*) Relates to an icing machine for biscuits, the machine having a horizontal rotary stencil plate with apertures which are closed by biscuits during the application of the icing thereto, a strickler for wiping over the apertures, and means for deflecting or directing the icing towards and over the apertures, being provided.

PRODUCTION OF BUTYL ALCOHOL AND ACETONE. **Distillers Co., Ltd.,** and **H. B. Hutchinson,** of Harpenden, Herts. 319,642. June 25th, 1928. In the production of butyl alcohol and acetone by fermentation, the yield of either product may be increased and the yield of ethyl alcohol decreased by a suitable selection of a nitrogenous form of nutrition. Ammonium acetate is added to increase the yield of acetone, and ammonium lactate to increase the yield of butyl alcohol. By this means raw material such as manioc, usually regarded as too poor in protein, may be used. The salt may be added at one time, at intervals or continuously. Examples are given. (Specification 319,079 is referred to).—HEATING EVAPORATORS, STILLS, ETC., ELECTRICALLY. **J. A. Reavell,** of Westminster, London. 319,849. July 6th, 1928. Evaporators, stills and similar apparatus are heated electrically by means of immersion heaters in a fluid circulating between inter-communicating jackets. The circulation is assisted by a pump. An expansion tank is provided to allow for the expansion of heated fluid. (Specifications 318,340, 319,298, and 319,391 are referred to.

[1] Copies of specifications of patents with their drawings can be obtained on application to the following—*United Kingdom*: Patent Office, Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2 (price 1s. each). Abstracts of United Kingdom patents marked in our Review with a star (*) are reproduced from the *Illustrated Official Journal* (*Patents*), with the permission of the Controller of H.M.'s Stationery Office, London. Sometimes only the drawing or drawings are so reproduced. *United States*: Commissioner of Patents, Washington, D.C. (price 10 cents each). *France*: L'Imprimerie Nationale, 87, rue Vieille, du Temple, Paris. *Germany*: Patentamt, Berlin, Germany.

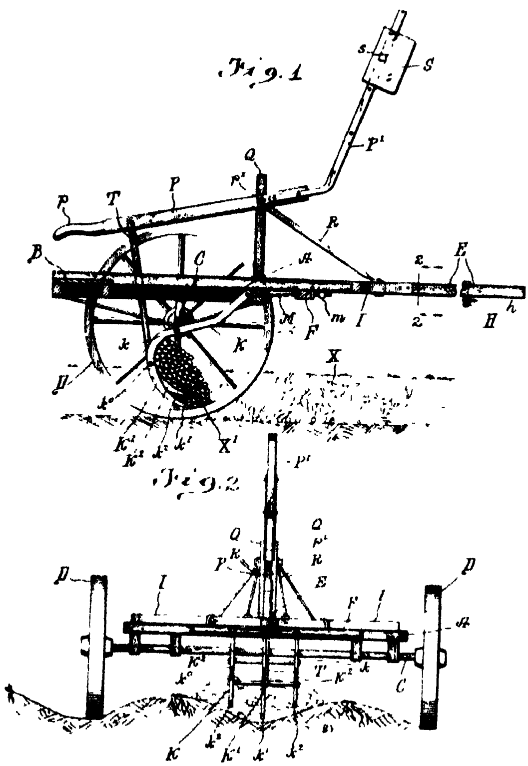
—GLUTAMIC ACID PRODUCTION FROM MOLASSES. **Deutsche Gold-und Silber-Scheideanstalt, vorm. Roessler,** and **K. Bromig,** both of Frankfort-on-Main, Germany. **320,589.** January 31st, 1929. Glutamic acid hydrochloride, from which free glutamic acid can be recovered in known manner, is obtained by boiling waste liquors (molasses distillery vinasses, etc.) with concentrated hydrochloric acid, separating insoluble organic matter from the hot solution, cooling the solution and separating the substances, principally alkali metal salts, which are then precipitated. The solution is then concentrated to about two-thirds of its original volume, any further precipitated substances are separated, and the concentrate is saturated with hydrochloric acid gas at temperatures below about 20°C. On standing, glutamic acid hydrochloride separates, and may be purified by dissolving it in dilute hydrochloric acid, decolorizing the solution with active charcoal, and re-precipitating with hydrochloric acid gas.—TREATMENT OF PULP SWEET-WATERS IN BEET SUGAR MANUFACTURE. **Duncan Stewart & Co. Ltd.,** and **J. B. Talbot-Crosbie,** of Glasgow. 320,826. January 14th, 1929. In the manufacture of sugar where the sugar is extracted by diffusion and the juice is purified by treatment with lime and carbon dioxide and filtered, the sweet-water separated from the pulp and the water pressed from the pulp in pulp-presses is neutralized by means of the filter-press cake from which it removes residues of sugar. The neutralized water is re-filtered and returned as diffusion water to the diffusion process.—MOLASSES PULP PREPARATION : AUTOMATIC WEIGHING DEVICES. **Soc. Anon. des Sucreries Ternynck, and L. Ternynck,** of Chauny, Aisne, France. 320,883. April 13th, 1928. Cattle fodder is prepared by mixing pulp from sugar factories in a dry state with molasses, and compressing it into briquettes. Preferably the molasses comprises 20 to 30 per cent. of the final product, and the mixture is kneaded before subjecting it to a pressure of 120-150 kg. per square cm. Pulp from a hopper falls into a skip until the skip is over-balanced by the weight of the pulp, which falls into a mixing vessel having rotary blades. When the skip tilts, the hopper is closed and a catch released, allowing a lower skip for molasses to move into loading position. When the upper skip empties, it is moved back to loading position by a counter-balance and causes the hopper and molasses outlet to open. The tilting of the lower skip closes the outlet, and moves a catch into a position allowing the upper skip to tilt when filled. (Reference has been directed by the Comptroller to Specification 4919/07).—REFINING METHOD. **Eugene N. Ehrhart,** of 72, Wall Street, New York, U.S.A. 320,982. August 13th, 1928. Sugar juices and melts, syrups, affinations and molasses are refined by filtering a sugar solution of a relatively low density, thereafter adding unfiltered sugar values to the filtrate to increase substantially its density and filtering the sugar solution of increased density. A vegetable carbon of relatively low purifying power as the result of previous use is used as filtering agent for the low density solution, and a filtering agent of relatively high purifying power is employed after the sugar values have been added.—DRYING GREEN BAGASSE.[1] **Henry W. Holgate,** of Jamaica. 317,172. June 14th, 1928. Apparatus specified for drying megass or other vegetable matter comprises an endless band conveyor within a housing, a perforated deck-plate supporting the upper length of the conveyor band, and a pipe having branches supplying hot gases to the under side of the deck-plate, the gases being exhausted from the upper part of the housing.—EVAPORATOR. **A. E. White** (communicated by the **Swenson Evaporator Co.,** of Harvey, Ill., U.S.A.). 321,698. May 18th, 1928. In a process for evaporating or distilling liquids the liquid is pumped by a pump at high velocity through a straight and unobstructed path to the bottom of vertical tubes surrounded by a heating jacket, the liquid boiling within the tubes and issuing at the top at high velocity, a head of liquid at the top of the tubes being at all times avoided. —STRIPPING SUGAR CANE. **C. Frycz and I. Darquier,** of Buenos Aires. 321,285. September 27th, 1928. Apparatus for peeling sugar cane, etc., comprises a number of blades mounted on a rigid tubular holder which consists of two parts hinged together so that it can be opened for the reception of the cane. Loops are provided for the fingers and thumb, and the holder is connected by straps to a wrist-strap.

[1] This invention has been more fully described, see *I.S.J.* 1930, 32.

UNITED STATES.

CANE PILING MACHINE. **John M. Caffery,** of Franklin, Louisiana, U.S.A. 1,718,852. June 25th, 1929.

A machine is described[1], the purpose of which is to gather up the cane stalks thrown more or less carelessly in an irregular layer, heaping them into bundles, which may be caught up with a cane grab, or readily bound with slings. In the drawing the principal parts of the machine are illustrated, in combination with a vehicle body provided with a driver's platform *B*, an axle *C*, and wheels *D*, supporting the body, a tongue *E* rigidly connected with the body, a breast pole *H* pivoted to said tongue, means for attaching draft animals to the vehicle body, etc. Pivoted beneath the wheel body, as at *k*, is the rake *K*, which is composed of three or more hook-shaped arms, the centre one *X'*, having its hooked end *k'* project lower than the hooked end k^2 of the side hook K^2, so that this centre hook of the rake will project down further into the furrow between the rows. This hook is held against turning too far backward by the chain *M* secured to the wheel body. In order to regulate the depth to which the rake teeth engage, the length of this chain may be adjusted in any convenient way, as by the device indicated diagrammatically at *m*. This rake is thrown into or out of operation, after the manner of a hay rake, by a device, which will now be described. *P* represents a hand lever, having the handle *p* within easy reach of the driver mounted on the platform *B*, which lever is pivoted, as at *p'*, to the uprights *Q*, which uprights may be braced in any convenient way, as at *R*. This lever *P* carries a weighted arm *P'*, preferably bent at an angle upward. This weighted arm may be made of sufficient weight of itself to counterbalance the weight of the rake and its load, or it may be provided with a sliding weight *S* adjustably connected to said arm *P'*, as by means of a set screw *s*. Pivotally attached to the lever *P* near the handle is the lifting rod or link *T*, which is connected to the cross piece k^0 of the rake *K*, as shown most clearly in Fig. I. Thus by pressing down on the handle *p*, the rake may be forced down against the action of the weighted arm *P'*, while by lifting up on the handle *p*, the weighted arm will tend to lift the rake with its load.



In operation, the rake is preferably drawn by two mules, or horses, hitched to the single trees, driven to a position straddling the heap row. As the vehicle progresses, the three-pronged rake will gather up, and in a measure straighten out the cane stalks *X*, until a bundle *X'* of the desired size is gathered up; then if the driver raises up on the handle *p*, this bundle of stalks will be released from the rake, and will

1 See also *I.S.J.*, 1929, 629.

form a pile, extending across the furrow between the two rows ready to be lifted by a cane grab operated on a derrick and leaving a convenient space for passing beneath the bundle one or more slings, such as are well known in the art. If large bundles are desired the bundles may be hoisted by a cane grab operated with derricks, or slings may be used for hoisting with derricks, but if small bundles are desired for lifting by hand, by gathering up and straightening out the cane stalks by the rake, as just described, it will leave a clearance space under the bundles, for the loaders to grasp the bundles, and throw them into carts, or other vehicles, used in this art. After the bundle of gathered up stalks has been taken up and the vehicle continues forward, the rake is lowered, and another bundle is gathered by the rake and deposited, and the operation may be repeated indefinitely. By having the weight *S* adjustably mounted on the arm *P'*, the counter-balancing effect of said weight may be adjusted, so that the machine may be fitted to gather the cane stalks into large piles, or small ones, according to the adjusted position of the weight. Thus it will be seen that with the foregoing implement, the tangled mass of cane stalks may be, more or less, straightened out in such a way as to be conveniently handled; and also that the bottom of each bundle, when released, will normally rest clear of the ground, so that considerable saving in manual labour in either adjusting the slings or lifting the bundles is effected.

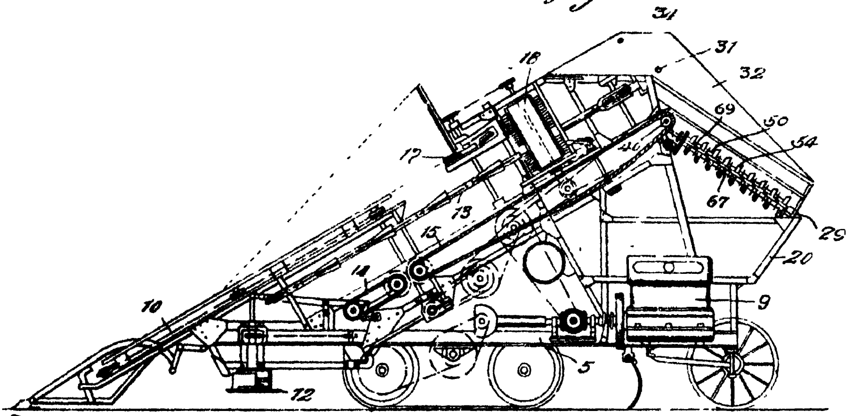
CANE HARVESTER. **Fred. C. Douglas Wilkes and Francis K. Flynn** (assignors to the **Luce Cane Harvester Corporation,** of New York). 1,722,780. July 30th, 1929.

This invention is particularly useful, in connexion with a harvester of the general type described in the application of GEORGE D. LUCE.[1] In this type of harvester, means is provided for seizing the cane, cutting it first at its butt, conveying it in a substantially standing position and then in a rearwardly inclined position upwardly and rearwardly through the machine, topping and stripping the cane while so conveyed, and then discharging it from the upper rear end of conveying means. The present invention relates particularly to means for handling the cane after it is discharged from the conveying means, and for removing from it any trash which would otherwise be delivered with the cane. One of the features of the invention is a transversely arranged bar which engages the cane as it leaves the conveying means and causes it to tip forwardly, thereby insuring that the cane will be delivered butt-first from the rear of the harvester. This feature is particularly, although not exclusively, useful in connexion with another feature of the invention which is the trash picker into which the cane is delivered butt-first from the conveying means. Generally speaking, the trash picker is in the form of an inclined trough, the bottom of which is provided with means, such as picker brushes, for removing from the cane any trash that may enter the trough with the latter. Other features of the invention will appear from the following description of one embodiment of it, and will be particularly pointed out in the appended claims. Referring to Fig. 1, the harvester is shown as having a main frame 5 mounted upon a caterpillar tractor treads 7, and provided with an engine 9 for propelling the apparatus and driving the various mechanisms thereof. At the front of the machine are pick-up chains 10, which gather in the cane and hold it while it is cut close to or below the level of the ground by the rotary disc cutters 12, which are shown in their raised or inoperative position. When the cane has been severed from the roots, it is seized by conveyor chains, one of which is indicated at 13, and is conveyed in a substantially upright position, upwardly and rearwardly through the machine. As the cane is thus conveyed, the butts engage the forwardly travelling belt 14 which tilts the cane into a somewhat rearwardly inclined position; and the cane is supported in this position by the engagement of the butts with the elevator belt 15. While so conveyed, the tops of the cane are cut off by the topping mechanism 17; and most of the leaves are stripped off by the strippers 18. After being acted upon by the strippers, the cane, which is still held by the conveyor chains 13 in a substantially upright but slightly rearwardly inclined position, is ready to be delivered to the trash picking mechanism which will now be described. No more

[1] U.S.P., 1,541,231.

detailed description of the general features of the harvester is necessary, since their specific constructions have no bearing upon the present invention. The trash picker mechanism is shown as mounted at the rear of the harvester upon an auxiliary frame 20 attached to the main frame of the machine. The trash picker is in the nature of an inclined chute having side walls and a bottom composed of trash picker brushes. These brushes serve to remove from the cane, as it passes through the trough, any free trash, which may be mixed with the cane and also any trash actually clinging to the cane. In order to clean the trash from the picker brushes and rotary brush cleaners 29, are provided outside of the trough and in co-operative relation to the picker brushes. As will be obvious from Fig. 1. the trash picking mechanism is arranged at an incline below the top of the conveyor belt 15, and is thus adapted to receive the cane stalks therefrom. Owing to the high rate of speed at which the conveyor chains 13 and the belt 15 are operated, the stalks would have a tendency to dive into the trash picking mechanism in a more or less haphazard manner, if it were not for the provision of means for causing the stalks to enter the trash picker butt-first with a sliding motion. This means comprises a rod 31 arranged across

Fig. 1



the guide walls 32 between which the stalks travel at the upper portion of the machine, this rod being so located that the stalks will engage it and will be tipped in a forward direction after they have left the conveyor chains 13 by the pushing action of the conveyor belt 15. This tipping of the stalks in a forward direction is limited by another rod 34, also arranged between the guide walls 32, but in advance of the rod 31 and the forwardly tipped stalks are thus prevented from falling against succeeding stalks. As the butt ends of the stalks leave the conveyor belt 15, they slide end-wise downwardly over an inclined apron which forms the bottom of the upper end of the trash picker chute; and from this apron the stalks go endwise butt-first downwardly over the picker brushes by which the trash is removed. The stalks are then discharged from the machine, preferably either upon the ground or into a trailing wagon.

FILTER. **Ernest J. Sweetland** (assignor to the **United Filters Corporation,** of New York 1,734,652. November 5th, 1929. In a filter is combined a non-rotating casing, rotatable hollow shafts journalled in each end of said casing, an open rectangular frame in said casing connected at each end to said shafts and adapted to rotate therewith and a plurality of filter leaves supported in said frame.—DISINTEGRATION OF CANE. **William H. Morgan, Sr.** (assignor to the **Morgan Hurrycane Co.,** of New York). Re-issue, 17,513; original, 1,646,761. December 3rd, 1929. A machine for disintegrating cane stalks comprises in combination cane confining walls separated by a relatively narrow space through which the cane stalks are passed, and means for splitting the cane stalks in general directions longitudinally of the stalks while confined in the narrow space between said walls to reduce the same to a fibrous mass.

UNITED KINGDOM.—Figures of Imports and Consumption for the past Three Years and for 1913.

(From Czarnikow's *Weekly Price Current*).

Refined—	1929. Tons.	1928. Tons.	1927. Tons.	1913. Tons.
Czecho-Slovakia	29,139	100,366	133,080	*198,064
Holland	13,857	87,866	185,546	178,567
Belgium	1,138	3,762	9,325	49,764
Germany	1,017	1,080	20,769	465,453
Poland	—	3,833	5,734	—
France	30	37	—	26,570
Hungary	—	—	27	—
U.S.	10,518	15,232	42,885	385
Canada	10	6,169	52,475	—
Natal	—	3	229	—
Cuba	44	62	6,709	—
Others	240	2,985	11,937	3,742
Total Refined	55,993	221,395	468,716	922,545
Entered for Consumption	54,708	219,625	522,312	899,327
U.K. Refined—				
Entered for Consumption	3,338	335,011	880,040	715,661

* Austria-Hungary.

Raws—	1929. Tons.	1928. Tons.	1927. Tons.	1913. Tons.
Poland	57,205	22,765	6,454	—
Germany	33,757	460	4,320	472,026
Czecho-Slovakia	20,070	21,330	1,208	*160,858
Austria	—	—	—	—
Hungary	—	—	190	—
Russia	—	6,388	—	—
Holland	2,296	11,665	—	—
Cuba	681,652	704,393	356,146	224,227
San Domingo	197,475	208,971	137,767	9,412
Peru	125,805	100,299	133,518	27,487
Java	168,854	8,106	10,264	99
Brazil	11,637	18,017	40,543	5,133
Venezuela	350	3,309	4,763	—
Honduras	—	12,395	10,051	—
Argentine	—	14,097	38,934	—
Mozambique	23,124	200	6,655	—
Mexico	—	—	3,333	4,134
Hayti	2,548	4,658	—	—
Dutch Guiana	2,728	5,013	2,849	4,606
British India	—	255	100	3,850
Mauritius	272,181	184,062	192,565	20,075
B.W.I.	91,918	138,414	92,296	47,736
Natal	97,383	71,484	43,887	—
Australia	223,209	151,450	83,328	—
Fiji	12,343	6,655	—	—
Ecuador	5,250	—	—	—
U.S. (Cubas)	10,400	13,976	—	—
Others	15,048	784	7,747	67,072
Total Raws	2,055,233	1,709,146	1,176,918	1,046,715
Entered for Consum'n	1,888,183	1,239,655	138,648	116,942
Total Imports Raw and Refined	2,111,226	1,930,541	1,645,634	1,969,260

Home-grown Sugars are not included in above figures.

United States.

(Willett & Gray.)

(Tons of 2,240 lbs.)	1930. Tons.		1929. Tons.
Total Receipts, Jan. 1st to Jan. 25th	141,486	..	118,516
Deliveries „ „	183,949	..	130,944
Meltings by Refiners „ „	174,243	..	161,379
Exports of Refined „ „	1,500	..	5,986
Importers' Stocks, January 25th	394,808	..	85,803
Total Stocks, January 25th	564,108	..	120,092
	1929.		1928.
Total Consumption for twelve months	5,810,980	..	5,542,636

Cuba.

STATEMENT OF EXPORTS AND STOCKS OF SUGAR, AT DECEMBER 31ST.

(Tons of 2,240 lbs.)	1927. Tons.		1928. Tons.		1929. Tons.
Exports	4,099,127	..	3,728,618	..	4,666,944
Stocks	212,314	..	124,403	..	181,460
	4,311,441		3,853,021	..	4,848,404
Local Consumption..	146,000	..	68,857	..	98,362
Receipts at Ports to December 31st ..	4,457,441	..	3,921,878	..	4,946,766

Habana, December 31st, 1929. J. GUMA.—L. MEJER.

Sugar Crops of the World.

(Willett & Gray's Estimates to January 9th, 1930.)

	1929-30. Tons.		1928-29. Tons.		1927-28. Tons.
CANE.					
America	9,094,933	....	9,146,147	....	8,147,901
Asia	7,199,537	....	7,315,485	....	6,891,715
Australasia	601,000	....	630,717	....	588,163
Africa	702,000	....	745,364	....	656,360
Europe	——	....	——	....	9,000
Total Cane	17,597,470	....	17,837,713	....	16,293,139
BEET.					
Europe	8,384,000	....	8,360,235	....	8,031,874
U.S.A.	975,000	....	938,640	....	965,241
Canada..............	32,000	....	28,857	....	27,212
Total Beet	9,391,000	....	9,327,732	....	9,024,327
TOTAL CANE AND BEET....	26,988,470		27,165,445		25,317,466

United Kingdom Monthly Sugar Report.

Our last report was dated 10th January, 1930.

The market has been very unsettled during the period under review. In the United Kingdom the uncertainty about the Preferential Duties is still causing an uneasy feeling. This fact, coupled with the unsettled conditions in Cuba, has made a very nervous market.

The London Raw Terminal Market has again been very active, and large quantities of sugar have changed hands. The principal movement has been in the month of March which sold at one moment down to 5s. 5¼d. and later recovered to 6s. 6d. May moved from 7s. 8¼d. to 6s. 8¼d. and advanced later to 7s. 5¾d. A large business has been done in August from 8s. 2¼d. to 7s. 4½d. to 8s. 1½d. to 7s. 10⅛d., and December moved from 8s. 5¼d. to 8s. 8¼d. to 8s.

In the White section business has been very slow and only a few thousand tons have been reported. Generally speaking the market has declined about 6d per cwt. March sold from 10s. to 9s. 3d., May from 10s. 6d. to 10s., and August from 11s. 0¾d. to 10s. 6d.

The latest prices are :—

	MARCH	MAY	AUGUST	DECEMBER
Raw	6s. 5¼d. ..	7s. 5¼d. ..	7s. 10⅛d. ..	8s. 0¾d.
White	9s. 3¾d. ..	9s. 11¼d. ..	10s. 6d. ..	—

The Trade has been very quiet and is buying sparingly in view of the approaching Budget.

The Refiners reduced their prices 3d. on the 20th January and another 6d. on the 22nd. On the 30th January they were advanced 3d. per cwt. Their latest price is No. 1 Cubes 25s. 9d., London Granulated 22s. 4½d. Home Grown Sugars have moved in sympathy and are slow ; to-day's prices are 20s. 6d., 21s. 6d. according to Factory.

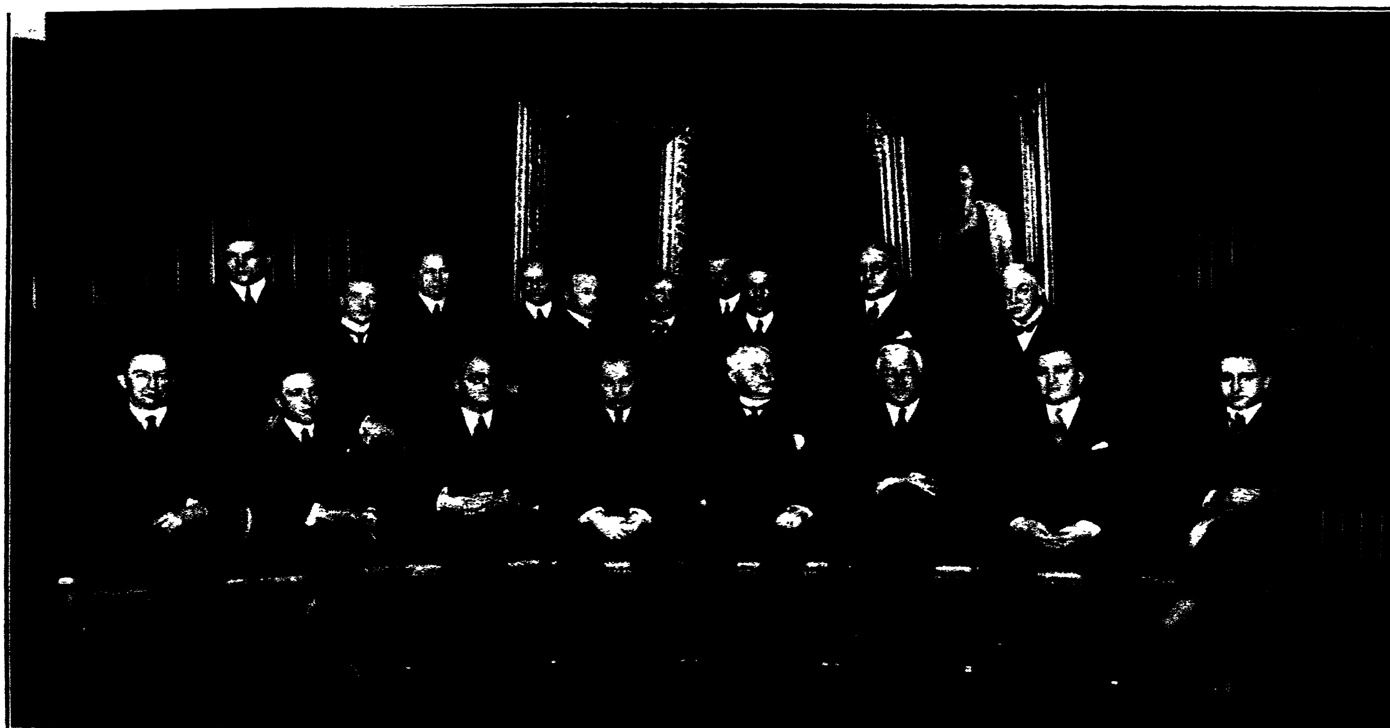
Raw Sugars have been slow of sale and our Refiners have only bought small parcels afloat or near at hand, at prices from 7s. 6d. down to the lowest point, 7s. Considerable quantities of Preferential Sugars have been disposed of to the Refiners and also to some Home Grown factories, the latest sale being some Mauritius at 11s. 3d. c.i.f.

There have been constant rumours from Cuba and New York, that there will be some restriction in the present and future crops of Cuba, but, so far, nothing definite has materialized. The Single Seller made one sale of 20,000 tons at 1·50 f.o.b. for export outside U.S. and later sold small quantities at 1·60. He also reduced his price in America to 2 cents, and on the guarantee that the price would not be reduced for a month, the American Refiners took about 120,000 tons, whilst full duty sugars, such as Porto Ricos and Philippines, were sold at a parity of 1⅞.

With regard to Europe, F. O. Licht has reduced his estimate to 8,339,000 tons. This reduction has been principally brought about by a falling off in Russia of 125,000 tons and an increase in other European countries of 50,000 tons.

21, Mincing Lane,
London, E.C.3.
10th February, 1930.

Arthur B. Hodge,
Sugar Merchants and Brokers.



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The Chadbourne Delegation at Amsterdam.

A Group consisting of the Members of the Cuban-American Sugar Delegation and the Representatives of the United Java Sugar Producers Association.

Standing (left to right): Messrs. E. Bennink, R. A. Barendsen, J. G. Wiebenga, Ph. J. Priesman, W. G. F. Jongeman, A. W. Hartman, J. Brouwer, G. Vermay, A. A. Pauw, and H. C. Prinsen Geerligs.

Sitting (left to right): Messrs. Ives Lee, J. Gomez Mena, J. M. Lopez Oña, V. Gutierrez, C. J. K. van Aalst, Th. L. Chadbourne, W. C. Douglas, G. Oña.

THE

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☞ The Editors are not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

The Editors will be glad to consider any MSS. sent to them for insertion in this Journal, and will endeavour to return the same if unsuitable; but they cannot undertake to be responsible for them unless a stamped addressed envelope is enclosed.

No. 384. DECEMBER, 1930. Vol. XXXII.

Notes and Comments.

The Chadbourne Negotiations.

We went to press last month before the results of the deliberations in the Cuban Congress on the Chadbourne proposals were known. This month we close while the deliberations in the Sugar Conferences in Amsterdam and Brussels are proceeding, and it is not impossible that ere these lines are read the result of these latter meetings will be given out to an eagerly expectant sugar world. It is therefore futile to anticipate the decision arrived at ; but it may be said that whatever the result, be it success or failure, there is no doubt that a spirit of mild optimism is in the air, since it is recognized that the conditions are now such that the deliberating bodies are bound in their several and joint interests to seek some constructive means of getting the sugar market out of its hopelessly uneconomic position, or else things may go even worse. Whether Java's requirements are met or not, the Chadbourne party can not very well now withdraw ; they must go on to get the best they can, or they stand to lose very heavily in respect of their financial commitments in Cuba.

The Chadbourne proposals were approved by both the Cuban House of Representatives and by the Senate when they met during the second week in November (the voting by the House is reported to have been 91 to 13 in favour). The Sugar Stabilization Law, devised for the segregation of one and a half million tons of sugar and the financing of the transaction, was next rushed through and was put into force within a few hours of passing the Senate. It would appear that little time was allowed to analyse the new laws or to foresee their consequences, and there was an under-current of doubt, if not of opposition, even by some of those who were otherwise convinced of the need for drastic action. But it was evidently realized that with the rejection of the Chadbourne plan, the chances of any other means cropping up to save Cuba financially and economically were very small. Mr. GUTIERREZ is reported to have demurred strongly to the condition that the Cuban crop should be further restricted in amount, but Mr. CHADBOURNE and his advisers appear to have been adamant. This reduction seems to be a certain eventuality, for if the Chadbourne party's aid were withdrawn, reduction in the 1931 crop would automatically follow, since far too many of the mills

are in financial difficulties to be able to grind normally if the banks refuse further aid. But if Cuba is now saved from the worst that can befall her, her immediate prospects may turn out to be only a shade better. The view is held that the banking interests who are at the back of the Chadbourne plan have designed the scheme with some idea of lifting the load from the banks and spreading it over the Cuban industry. If improvement is carried far enough, this industry may well benefit in the long run, but, as our Cuban correspondent remarks, the Cuban producer runs the risk of not being able to call his soul his own during the currency of the new sugar laws, while he is too strongly entangled in the financial net to be able to break away.

With the Havana business completed, Mr. CHADBOURNE's party lost no time in transferring the scene of their negotiations to Europe, and they reached Amsterdam in the last days of November. Meantime, on November 22nd, there was a preliminary conference at Berlin of the German, Czecho-Slovakian and Polish interests to discuss their attitude at a general sugar conference at Brussels. About the same time the annual meeting in Holland of the Java Sugar Producers' Association (the V.J.P.) took place and was adjourned for ten days, giving rise to rumours in the sugar market of impending dissolution. Probably the meeting was not as unruffled as usual, since some of the smaller members in Java have undoubtedly been dissatisfied with the trading conditions of the last two years. But it would have been strange if the trade-bank interests in Holland, who control the bulk of the shares in the Association, had elected to break up its unity at the very moment when it was important that Java interests should speak with one voice at the most important sugar conference since the days of the old Brussels Convention. As it was, the subsequent meeting confirmed the control of the V.S.P. for another twelve months, and so the controlling body was free to meet the Chadbourne party at Amsterdam on November 29th and subsequent days.

The meeting of all the sugar interests (Cuban-American, Dutch, and European Beet) was fixed to be held at Brussels on December 4th. But it was contingent on a certain outcome of the preliminary pourparlers at Amsterdam. These last were hampered by the indisposition for a few days of Mr. CHADBOURNE; but, nevertheless, they progressed sufficiently at the outset to warrant the formation of committees to examine details and report to the plenary meeting of the conference. The Brussels meeting was postponed till the 9th December, by which time, we learn as we go to press, the Amsterdam preliminaries had had a successful outcome.

The Chadbourne party consists of Mr. T. L. CHADBOURNE, Dr. V. GUTIERREZ, Messrs. J. GOMEZ MENA, J. M. LOPEZ OÑA, W. C. DOUGLAS, G. OÑA, and IVES LEE. Colonel TARAFA is not included. The Java Delegation has Dr. C. I. K. VAN AALST as its president, while Dr. H. C. PRINSEN GEERLIGS acts as Statistical Adviser. The Brussels Conference was to be under the presidency of Senator BEAUDUIN, the head of the Raffinerie Tirlemontoise. English sugar producers were invited to join in the Brussels deliberations, and have sent representatives, according to the news to hand.

If there be any further incentive to add to those influencing the delegates to these conferences, it will be found in the latest figures issued by LICHT of the European sugar crop of 1930-31. Including Russia (whose own estimates are now accepted by LICHT) there is an increase indicated of practically two million tons, as compared with 1929-30, and when allowance is made for

imports of sugar which have markets guaranteed them in Europe, it would appear that something like three million tons of beet sugar will be available for export from the European areas. Truly, it seems time to cry a halt in this over-production.

The Working of the V.J.P. in Java.

When Mr. J. W. F. ROWE, of the London and Cambridge Economic Service,[1] paid a visit to Java last summer to study the economics of the sugar marketing system in vogue there, he probably had little idea that the date of publication of his studies would synchronize with the calling to a conference in Europe of the leading sugar producing interests of the world, including those that for 12 years past have swayed the destiny of Java sugar. To have at this stage what is the most complete account, in English, of the development and working system of the United Java Sugar Producers Association will doubtless prove of considerable value to those who, directly or indirectly, are concerned with the CHADBOURNE sugar conference, which at the time of writing has, after several months of sparring, at length come to grips with the sugar problem. Mr. ROWE in his survey[2] of the history of this centralized selling organization, which controls fully 90 per cent. of the Java output of sugar, gives us an insight into the reasons that have finally led the Dutch sugar producers, after rejecting for some years the pourparlers of Cuba, to enter the conference chamber with other big world producers of the same commodity and seek for a possible solution of the present highly uneconomic position of the industry. So long, in effect, as Java could sell her crop well in advance and made a reasonable profit on it, she would not hear of restriction. But the experience of the last two years has not been so happy a one for her, as her crops have not sold quickly and prices have continued on a downward grade, till the last few months appreciable lots of the current crop have been marketed at a price below the average cost of production in Java.

When Java, still the cheapest producer of sugar in the world,[3] finds that the world price for her has reached uneconomic depths, it may be assumed that the time is ripe for a concerted effort to rectify the fault. So, now it is clear that the more recent proposals emanating from America are not merely those of Cuban politicians, but have a strong financial backing from those American banks who have sunk considerable sums of money in the Cuban sugar industry, it would be little short of suicidal on the part of Java to refuse to explore with the other parties the range of possible solutions. This much can be said at a moment when success and failure are in the balance, and we are without any idea of the period of time that must elapse before the Conference can terminate its labours and announce its findings.

Mr. ROWE, as one of his critics points out (on another page), while investigating his facts with painstaking care, has evidently drawn up his memorandum with too large an assimilation of the point of view of the buyer of the Java sugar, and has in part misunderstood the motives of the producers' organization. His final conclusion that Java producers should refuse to face

1 A body which includes such names as Sir. W. H. BEVERIDGE and Mr. J. M. KEYNES on its Executive Committee.

2 We summarize it on another page.

3 But what her figure of costs of production really is, the authorities do not seem to be agreed. Dr. FRANCIS MAXWELL, in our October number, concluded from his investigations on the spot that it was less than 8s. per cwt. (Fl. 9·4 per 100 kgs.). On the other hand Mr. ROWE, who also made enquiries in Java, was the recipient of various figures from different authorities, ranging between Fl. 10 and Fl. 11. Some mills could probably produce at Fl.9, and the cost of producing 75 per cent. of their crop may be under Fl. 10; but the average for all mills, he says, is probably about Fl. 10·50. In 1926, he adds, before the advent of POJ 2878, the gross cost was put at Fl. 13 59, i.e., inclusive of rates, taxes renewals and depreciation.

the difficulties of stockholding and should if necessary throw their unsold balance of 1930 on the market at any price, rather than be unable to start the 1931 season with empty warehouses, seems to us essentially the buyer's point of view. The producer may well conclude that the time is ripe for trying other methods than unlimited competition in a buyers' world market and it may turn out to be the case that the V.J.P. will decide to face the difficulties of stockholding and, like Cuba, try the plan of rationing the market for some years.

Why Continue Research? An Answer.

In a recent Note and Comment the opinion was upheld that, in the recurring periods of depression in the cane sugar industry, while every effort should be made to cut down expenses and produce economically, the one thing to avoid was to discontinue research in the cane fields. And since that Note was printed, two separate cases have come to light which strongly support this point of view. In our last issue a brief review was printed of results of research, maturing in Hawaii, on the way in which water is absorbed by the cane plant, making use of the latest methods developed in this study. And as an incidental result of this work a provisional estimate was made possible of the proportion of water, which was collected for the cane fields, which ultimately was used in the cane plants. It appears that from five to ten times the water actually absorbed by the plant has to be provided, in spite of the painstaking methods adopted to lose as little as possible en route. But, considering the enormous cost of irrigation works in Hawaii, and the comparatively small losses occurring in the supply of large cities often many miles distant from the source of supply, there is at least room for further research in the matter.

And in the present number of this Journal we print a review of the results of research in an entirely different direction, namely, in Entomology in Barbados. Here, at a cost of 3d. per acre of cane, it is estimated that the major portion of the present very heavy losses due to the moth borer may be avoided by the application of the latest methods used in the study of the parasitology of insects. The complicated technique required locally has been built up, and there is every reason, judging from last year's results, for entertaining the hope that the ideal aimed at will be reached during the present crop. And that ideal is simply to flood the cane fields throughout the island with a minute parasite of the mothborer, every three weeks during the danger months—to the extent of fifty to sixty millions a year. The very idea grips the imagination. This work has been gradually maturing for some time, and the author permitted himself to utter the following forecast in August 1929 : "It is however anticipated that an economic control (of the mothborer) can be obtained, which should yield sufficient increase to counteract the present depression in the sugar industry."

Tate & Lyle's 1930 Report.

The 1930 Annual Report of Messrs. TATE & LYLE LTD., the firm that has almost a monopoly of sugar refining in the United Kingdom, reveals no exception to the general depression that has spread over the sugar industry. As compared with 1929, the trading profits have dropped from £782,373 to £213,949 and the net profit after meeting debenture charges from £886,582 to £339,584. The dividend on the ordinary shares is reduced from 15 to 10

per cent. and to pay this it has been necessary to draw on the reserve and the "carry forward" to the extent of some 2 per cent. of the Ordinary capital. During the year some big changes have been effected in the balance sheet. Banks loans of £3,210,000 created to finance the acquisition of the Fairrie refinery and of certain beet sugar interests has been wiped out, apparently by the sale of some first class securities valued last year at £1,274,606, the issue of over a million sterling of extra debenture stock, and the reduction in the book value of sugar, syrup and stores by £951,000.

At the annual meeting Sir E. W. TATE, Bt., said that the firm's output had been greater than ever before, they had practically driven the foreigner from the U.K. refined market, and the margin of profit on day-to-day prices had been as good as in 1929. But the year turned out very different from what they had anticipated in the matter of raw sugar prices; these had declined during their financial year from 9s. 9d. per cwt. to 4s. 9d., or over 50 per cent. This low figure was more than 1s. below any previously recorded low price, and for a firm carrying large stocks of raw material it had very serious consequences. Their difficulties were further increased from the fact that the buyers, who in normal times cover their requirements for some time ahead, had shown every reluctance to run the risk of market fluctuations and consistently purchased no more than their immediate requirements, throwing the whole onus of the market risk back upon the refiners. Sir E. W. TATE added that the smaller figures for 1930 in the balance sheet were not due to a lesser volume of trade. He did not believe that the actual consumption of sugar anywhere shows much decrease, and they looked forward with confidence to a large and regular trade during 1931.

Leeward Islands Sugar Company Reports.

ANTIGUA SUGAR FACTORY LTD.—The 11th Annual Report of this company, for the year ended September last, shows that the sugar crop as compared with 1928-29 was of more normal dimensions, attaining 15,556 tons of sugar, as compared with 9104 tons in 1929 and 17,088 tons in 1928. The figures of Sucrose in Cane (14·58), Purity of Juice (84·88), Total Recovery of Sucrose (88·73), and the Yield of 96° Sugar (13·45), were all the best on record within the past seven years, while the "tons of cane to make one ton of sugar" was the lowest, being 7·41. Unfortunately the average price obtained by the Company for its sugar was only £10. 1s. 6d. per ton, as compared with £14. 13s. 1d. in 1928 which was considered a normal year. In view of the difficult financial position in which the estates were placed owing to an accumulation of losses through hurricane, drought and low prices, the Directors decided to pay the planters 14s. per ton of canes, cash on delivery, instead of on the ordinary basis which takes into account the quality of the juice. Under the latter terms they would have got in the event 13s. 6·57d., so the planters received nearly 6d. a ton extra, or some £2538. After charging revenue with the payment of canes, there remains a balance of £10,344 at Profit and Loss, this being the shareholders' profit for the year. This sum, together with the amount brought forward from 1929, leaves £27,574 at the credit of the shareholders; but owing to the outlook of the sugar market, the amount is carried forward and no dividend is being paid.

ST. KITTS (BASSE TERRE) SUGAR FACTORY LTD.—The 19th Annual Report of this company for the year ending September last shows that the factory had a successful season, and its output of sugar (18,680 tons) is the

second highest in the last seven years, being only exceeded by the crop of 1928 (19,443 tons). As with the Antigua factory, the chemical control figures were the best for the past seven years, Sucrose in Cane being 13·33, Purity of Juice 84·79, Total Recovery 89·12, Yield of 96° Sugar 12·38 ; while 8·08 tons of cane went to the ton of sugar. The average sale price realized for the sugar was £10. 6s. 2d. f.o.b. per ton, showing a drop of £4. 11s. 10d. on 1928, which was considered a year of normal prices. In this case too, the factory paid the planters at the rate of 14s. per ton of cane, c.o.d., instead of the figure which under the contractual terms would have been 13s. 4d. They therefore received an extra 8d. per ton, costing the Company £5006. After charging revenue for Sinking Fund and interest on debentures the sum of £12,404, there remains a surplus at Profit and Loss of £14,487 which is allotted, as to "B" shareholders £162 (being 5 per cent. interest); to "A" shareholders (the London holding company) £14,208. From this last £4500 is retained for Income Tax Reserve, and the balance of £9708 less income tax (£8494 net) goes to London. Hence the St. Kitts (London) Sugar Factory Ltd. with the amount brought forward from 1929 have £41,930 to dispose of, and recommend a dividend of 5 per cent., carrying forward £36,641.

The Need to Reduce Production Costs.

In the course of his annual speech as chairman of the St. Kitts company above referred to, Mr. G. MOODY STUART said that sooner or later we must see a recovery in sugar prices, but he did not think we could look forward to their being maintained throughout the future up to the average of recent years, say about £14 per ton, f.o.b. Improvements have been going on in the production of sugar, both in cane growing and in factory work, that have cheapened the cost in those countries that have introduced the improvements or have taken advantage of them. This cheapening in cost will as it spreads keep us from rising again to the old level. So if a living is to be made out of the industry, a way must be found to introduce improvements that will reduce the cost of production.

The improvements in the St. Kitts factory may be deemed to have kept pace with what has been going on elsewhere, and it is at a good standard of efficiency. Any further substantial improvements must be obtained on the estates. In St. Kitts their cost of labour at present is high. Mr. STUART suggests that the planters should endeavour to improve their system of field work by adopting labour-saving methods that are in use elsewhere ; an increase in ratooning if practicable would reduce the field costs considerably. The introduction of newer and better varieties of cane may well result in increased tonnage ; incidentally, POJ 2878 is already growing in St. Kitts and it will not be long before it spreads through the island, when it can be seen whether it is suitable for the locality. Mr. STUART also suggests that planters may find it advisable to abandon the use of animal manure in favour of heavy dressings of chemical fertilizers. In both Hawaii and Java not a particle of animal manure is used. In Hawaii there are estates that have no irrigation and where the rainfall is not more than in St. Kitts, and yet their yield of canes per acre is more than twice as much, and it all comes from heavy chemical fertilizing. Experimental plots have already been laid out on one or two estates in St. Kitts in order to find out whether this method of fertilizing will prove suitable, and the results will be awaited with interest.

The Marketing of Java Sugar.

Operations of the Java Sugar Producers' Association.

In our November issue we referred to a Memorandum issued by the London and Cambridge Economic Service from the pen of Mr. J. W. F. Rowe, consisting of two studies on the Artificial Control of Sugar.[1] One of these on recent Cuban sugar history we noticed in that number; the other on the Marketing of Java Sugar in Recent Years we now propose to summarize.

"The Marketing of Java Sugar in Recent Years" is, in effect, the history of the Vereenigde Javasuiker Producenten, or United Java Sugar Producers' Association, commonly known as the V.J.P., or in Holland as the V.I.S.P., which was started in 1918 in an attempt to stop the competition of the mills to market their sugar, which competition was driving down prices to an unreasonable extent. The V.J.P. started with a membership of rather more than 80 per cent. of the Java sugar industry, a figure which was quickly increased to 90 per cent. The contract for the members has always been on an annual basis only.

An annual meeting is held in Holland at which the members elect a Committee of Management, consisting of about 36 representatives, voting being by acreage under sugar cultivation. "This Committee delegates the actual business of selling to a sub-committee of three, and only broad questions of selling policy are ever brought before the full committee. It is this Triumvirate which constitutes the V.J.P. for practical purposes. The Triumvirate appoint the Java managers of their respective firms to be the representatives of the V.J.P. in Java, and they carry out the actual work of selling according to detailed, and not merely general, instructions from Holland. They also manage the internal affairs of the association, e.g. the allotment of contracts and the equalization of proceeds, and for this they can refer to a local 'Committee of Assistance' composed of the representatives of the sugar companies in Java. This Committee of Assistance is, therefore, in a way a counterpart of the Committee of Management in Holland, but, unlike the latter, it has not even a theoretical claim to any voice in the determination of prices or selling policy." This Triumvirate, as it happens, has always consisted of the heads of the same three firms, a circumstance due to the degree of combination which has been reached under the leadership of big banking-trading concerns which have gradually absorbed or gained control of one mill after another, mainly in the execution of mortgages. This absorption first began in the crisis of 1883 and has been a marked feature of every period of serious depression ever since. In addition, the banks have made direct investments in sugar mills on their own initiative. Some of the large merchant firms, too, have come to control a number of concerns that got into difficulties. The result is that in recent years seven concerns, with over 100 mills between them, have come to control no less than 75 per cent. of the industry, and the remaining 25 per cent. is by no means composed of single mill proprietors. The Triumvirate is composed of the three biggest, namely: The Nederlandsche Handel Maatschappij, controlling 25 mills, of which it owns at least seven outright; the N. V. Handelsvereeniging Amsterdam, which also controls 25 mills, of which it owns at least 14 outright; and the N.V. Ned.-Indische Landbouw Maatschappij, which controls 23 mills, owning at least eight outright. "These three concerns therefore control 73 out of the total of 178 mills in 1928, and since on the average their mills are larger than the average of the remainder, they may probably be said to control very

[1] Special Memorandum No. 31: Studies in the Artificial Control of Raw Material Supplies. By J. W. F. Rowe. No. 1. Sugar. (London School of Economics, Houghton Street, London, W.C.2.) Price 5s.

nearly, if not quite, 50 per cent. of the output. Since approximately 10 per cent. of the total crop is produced by mills which are not members of the V.J.P., it is clear that the Triumvirate maintains itself unchallenged simply because it controls well over half the voting power of the Association, and as long as the three agree to keep each other in office, nothing can disturb their tenure." Still any member can withdraw at the end of a season, and if the membership substantially declined, nothing would avail the V.J.P. Of the non-associated concerns, the most important are certain Chinese merchant firms, while several English and Dutch merchant houses own between them some eight mills. These non-associated mills are in present circumstances unlikely to come under the control of the V.J.P., unless they come into the market and are bought by V.J P. members.

The Sales Mechanism.—Mr. ROWE next goes into considerable detail to describe the sales mechanism of the V.J.P. The selling headquarters are in Holland, and the managers in Java work to orders as to the price at which they make their sales. Exporters and merchants make bids for the sugar to the V.J.P. office in Sourabaya, and these bids are usually neither accepted nor rejected till the following day, being referred to Holland for confirmation. Very rarely does the V.J.P. take the initiative and announce a definite price, and it is left to the bidder to ascertain what price the Trust, as the V.J.P. is often called, will entertain. Bids made on the same day at the same price are either all accepted or all rejected. But the Trust may and does alter its limit as it wishes, hence buying usually comes in spurts. Bids may be refused for weeks, and then on orders from Holland the limit is lowered and bids at a certain price are accepted, whereupon buyers rush in to make purchases before the Trust raises its limit again. The result is that for weeks "there may be insignificant dealings of a few hundred tons, mostly to test the Trust's limit, and then on one day business involving several hundred thousand tons may be transacted, after which the market will again quickly lapse into its former dormant conditions."

The price quotations are usually on the so-called "first cost" basis, that is, delivery in front of the buyer's scales at a port warehouse, which normally means that the sugar is shipped from the mill to the buyer's warehouse at the port at which delivery is to be given. It used to be almost unknown for unsold sugar to be stored at the ports , but during the last two or three seasons sales have lagged behind the rate of production, and the mills for lack of storage space have had to send the sugar to the ports to be stored in the warehouses of the V.J.P., which means that the big exporting firms have had the extra expense of moving the sugar, when bought, to their own warehouses, or else pay warehouse charges while their own warehouses stood empty. This has proved a real grievance ; and to remedy it many mills have been recently expanding their storage accommodation, but it takes several years before an asphalt or concrete floor ceases to "sweat" in the Java climate, and there has, incidentally, been a good deal of damaged sugar about recently.

Orders are usually accepted by the V.J.P. for delivery within a period of two consecutive months. Payment must be made in full on delivery : the V.J.P. also stipulate, in the case of a buyer whose credit is not well established, that security to their satisfaction shall be deposited within 14 days after the closing of the contract. The V.J.P thus makes no bad debts. In theory every mill has a proportionate share in every sale contract, but to equalize the distribution a monthly settlement is worked out according to the sugar content of each lot of sugar sold. Each month the V.J.P. calculates the aver-

age price obtained per unit of crystal content, and the value of the sugars sold by each mill, on this basis. Since the mills are paid direct by the buyers, the V.J.P. acts as a clearing house to receive from or pay to the mills differences between the actual sum paid and the basis value of the sugar. The production of high-grade sugars is stimulated by the granting of a bonus to mills whose sugar shows a certain margin above the average crystal content.

The First Ten Years.– Mr ROWE next proceeds to give an account of the first ten years' operations of the V.J.P. The difficulties which led to its establishment were not caused by any real excess of supplies, but simply by the shortage of shipping in the Far East. These difficulties caused a sharp contraction of acreage for the 1919 crop and affected the plantings for 1920, the year when top prices ruled and an average of F.54 per 100 kg. was obtained. But the V.J.P. policy of selling much of the crop in advance probably saved Java from the worst of the ensuing slump. Yet during the crops of 1918 to 1926 the V.J P. cannot be said to have pursued any definite policy; its practice was to sell as much as possible well forward, and to dispose of the remainder of the crop at whatever price concessions were necessary to prevent any real accumulation of stocks The V.J.P., then as now, was simply a centralized marketing agency, and that it was content to be so very largely accounts for its success. But admittedly it was operating under relatively favourable and easy conditions until the last three or four years. In 1926 unfavourable weather reduced the crop and rendered it easier to dispose of the output at a time when several of Java's customary markets were not available. The V.J.P. handled that crop with admirable success, and in 1927 a much larger crop was successfully disposed of at good prices. At this date Colonel TARAFA came on the scene, but Java was not unnaturally indisposed to discuss control. The Eastern market was supposed to be in a healthy condition and what with their low cost of production and their central selling organization the Dutch were confident they could survive until the mortality amongst other producers brought world production again into line with consumption. Summarizing the activities of the V.J.P. down to 1927 Mr. ROWE concludes that it had marketed wisely and well and made the most of the generally favourable conditions; that it had been tested in really heavy weather he is inclined to doubt.

The 1928 Crop.—With 1928 came difficulties on the scene. In that year the crop increased considerably, thanks to two-thirds of the acreage being planted with the new POJ 2878 cane. Buyers did not fancy the prices and held off, and by May when the mills started to grind little more than one-third of the output had been sold in advance, so the mills had to start storing the sugar. At the beginning of the year the V.J.P. had secured a price of F.16, and till July would not accept below F.15·25. Then it threw up the sponge and accepted F.13·50. During the interval the second-hand market, profiting from a shortage of supplies, dealt in prices fluctuating between F.18 in April and F.14 at mid-June; but the V.J.P. probably over-estimated the demand likely to arise and the size of the coming crop. The increase in demand soon faded away, and the V.J.P. did only right in coming down to F.13·50. By the Autumn, world over-production was more self-evident, and the V.J.P. at the end of September had still a million tons unsold. Since to lower its price still further would have inflicted heavy losses on its regular buyers who had already satisfied their requirements, the V.J.P. had to resort to a differential price policy, and make offers at lower prices for destinations west of Suez which were freely accepted. Thereby it managed to dispose completely of its enormous crop of nearly 3 million tons at an average price of F.13·10.

The 1929 *Crop.*—The year 1929 brought more difficulties for the Triumvirate. A mild corner engineered by two big exporting firms, who bought up the balance of the 1928 crop and the bulk of the 1929 deliveries to the end of May, sent the second-hand market price well above that of the V.J.P., and the V.J.P. sales for future delivery ceased for the time being. When the grinding season arrived, the world price outlook was steadily downward and the V.J.P. had to reduce its prices to F.12; but even this failed to stimulate any general outburst of buying, for the buyers seemed to think the position of the mills was desperate enough to warrant the V.J.P. climbing down further. The latter elected to make no further move; meantime the mills, encumbered with unsold sugar, got into financial difficulties and had to have recourse to the banks, to finance the new plantings. In spite of this, the V.J.P. held out longer than their customers and won. They kept to their minimum of F.12 and eventually raised it to 12½ and then to 13, which means that the price they obtained more than covered the cost of loans and warehousing charges. At this price the crop was steadily disposed of through the Autumn. Eventually at the end of the season the V.J.P. made the mistake of raising its price to F.13.50 and thereby choked demand, so that 150,000 tons remained unsold when 1930 dawned. The last portion of this old crop sugar (some 40,000 tons) was finally disposed of at F.9 last May.

The V.J.P.'s Problem.—Until the last two years the policy of the V.J.P. had been to sell forward and leave the dealers the risk of holding the stocks. If the mills made a reasonable profit, the V.J.P. did not grudge the exporters their success in making possibly large profits, this being their reward for shouldering the risks of changing values. But if the V.J.P. could only sell at prices that little more than covered costs, the mills would naturally be dissatisfied if the exporters made large profits. Hence, as prices dropped, the V.J.P. was forced to exact the best possible terms and the exporters were left to complain that they were being accorded an entirely insufficient margin of profit. The result was a policy of hand-to-mouth buying which left the V.J.P. with a large share of the risks of changing values, risks that they had hitherto been entirely free of. They may succeed in squeezing the exporters for a season or two, but the latter will not stand it for long, and if they retire from the scene, the V.J.P. will be involved in still further commitments.

The V.J.P. has therefore, according to Mr. ROWE, two alternatives. The first is to pursue a liberal policy of "live and let live" with the exporters, as in the past. The other is to take on its own shoulders the functions both of risk-bearing and of distribution hitherto performed by the exporters. Whatever the feelings of the great concerns which form the Triumvirate, the large majority of the other producers are probably most unwilling to shoulder the risks which this second alternative implies; their present risks as agriculturists are sufficiently heavy. For the marketing of Java sugar is a most intricate operation, as the exporters deal in small quantities with a very large number of wholesalers scattered over the Far East; it is not the question, as in Cuba, of passing on the sugar in large consignments to a few refineries. Hence the exporters as a body can hardly be dispensed with.

It may be asked why the V.J.P. could not continue the policy of more recent years of waiting to sell till the beginning of the harvest and thereby reducing the risk which the exporter has to undertake. The producers and exporters would then share the risks and the payment between them. This however, means that the non-associated firms would always be in a position to skim the cream off the market by selling their output before the V.J.P. at

prices below the V.J.P.'s current limit but a little above the level to which that limit would eventually be reduced. The inevitable result would be the desire of every member of the Association to be free to operate outside the Trust, and the latter's stability would be weakened in consequence.

On the other hand, if the Trust endeavours to return to the older practice of forward selling, it will not keep its members easily satisfied at present prices. The average cost figure for all mills is probably about F.10·50 If in 1930 prices had been such as to give an average of F.10-11, there would probably have been serious dissatisfaction. But actually the price has fallen much below this level (to F.9 in August), so the members probably feel that without the V.J.P. disaster would be imminent. For whatever it has not done, the V.J.P. does at least prevent competitive selling by the mills in a buyer's market. This, and its prevention of losses through bad debts, are its main merits.

In concluding his study, Mr. ROWE expresses the view that the Dutch are right in refusing to face the difficulties of stock-holding and direct marketing. Conditions are so different with them to what they are with Cuba, that what will suit Cuba will not necessarily suit Java. And he doubts whether a Single Seller in Java even with adequate financial backing would be of any benefit. Java is still in possession of the lowest costs of production, and Mr. ROWE believes that the V.J.P.'s best policy is to refuse to carry over a substantial amount of sugar into 1931 and by disposing of her remaining stocks at current prices to leave the way clear for a rise of prices to more reasonable levels. On the other hand, if the V.J.P. carries over say one million tons into 1931, the prospects of such a rise are diminished. But whatever the acuteness of the present crisis, the Dutch, says Mr. ROWE, may well conclude that the sugar industry of Java will survive to enjoy the prosperity which will in due course return, when a sufficient volume of capacity has been closed down in other countries.

***A distinguished Dutch correspondent who has read Mr. ROWE's paper on the V.J.P. supplies us with some comments. The paper is an instructive one, and on the whole Mr. ROWE is right in his facts, but he seems to have obtained his information mainly if not exclusively from the buyer's side. This is suggested from the fact that the calculation of the proportion allotted to the different sellers as given by him is quite erroneous. Then, he is mistaken in his impression that the three big companies, whom he calls the Triumvirate, habitually over-rule the others and cling to the cudgels of office. These three, who do the work without any remuneration and solely out of a feeling of duty, are appointed every year, anew, by the assembly of all the members. Moreover, they are not bigger than some of the other companies. The Cultuur Maatschappij de Vorstenlanden and the Koloniale Bank own and control at least as many units as any of the three belonging to the Triumvirate. And, incidentally, the latter do not compel the others to store their sugar in the warehouses of the Triumvirate.

Mr. ROWE presents the Triumvirate as a sort of autocratic tyrant to whom every one else has to defer, but this is not a just view. Every member is free to leave the V.J.P. at one year's notice, and if the interests of the smaller firms were really sacrificed to the domination of the three big ones, the sense of liberty and justice which is a characteristic of the Dutch would probably soon end any agreement that was deemed one-sided.

Cuba's Five-Year Plan.

By EARL L. SYMES.

The impending government control of the sugar industry in Cuba mentioned in our last article was placed in effect on November 15th. The Sugar Stabilization Law devised by American banking interests and a few Cuban mill owners was rushed through the Cuban House and the Senate; and it received the Presidential signature and was published in the Official Gazette within four hours after leaving the Senate. This Law provides for the segregation of 1,500,000 tons of the Cuban 1930 crop from the market, to be sold at the rate of 300,000 tons yearly during the next five years. An issue of $42,000,000.00 gold bonds, U.S. Cy., is authorized to purchase this amount of sugar and provide working capital for the marketing organization which is now set up to manipulate this sugar.

The President of Cuba is given complete control of the sugar industry. He is authorized to name eleven directors to manage the "Corporacion Exportadora Nacional de Azucar" (C.E.N.A.) as the new sales unit is called. He will with the C.E.N.A. make a contract with some bank or banks of international reputation to act as trustee for this bond issue; the trustee is to supervise the expenditure of the funds received from the sale of the bonds, an amount of $666,000.00 is to be deducted for use as capital of the C.E.N.A. The balance $41,334,000.00, assuming that par value is received, will be used to purchase the million and a half tons of sugar at the rate of $4.00 per bag f.o.b. shipping ports. This is equivalent to $1.213 per 100 lbs. av., f.o.b., and deducting usual shipping expenses to port, etc., of 0.113, the return on the plantation works out at $1.10, or $24.64 per long ton av. This is undoubtedly a higher price than was being received before the market reacted to this new plan; however, since the price advanced to $1.40 f.o.b., many holders were anxious to liquidate at the higher price. About 800,000 tons was contributed voluntarily and in order to secure the balance an emergency decree was issued in mid-October requiring all exports to obtain a permit. This enabled a study of all contracts to be made and it is hoped to set aside the remaining 700,000 tons from present stocks. The new Law stipulates that all exports during the next five years from November 15th must have an export licence and also all sales contracts must bear a clause permitting the substitution of C.E.N.A. sugars whenever desirable. This allows for the renewal of old stocks from new crop sugars.

The President is to determine the interest rate of the bond issue; it is understood that this will be at least 5½ per cent.; he will issue the bonds in lots suitable for absorption by the conditions in the bond market It is probable that holders of sugar will, when possible, take bonds for their sugar instead of accepting the discounted value that seems likely in the present bond market. The issue is supposed to be completed within twelve months. The President will also decide when bonds are to be called and the rate of payment. He is also authorized to decree crop restriction in accordance with any international agreements that may be entered into. The producers in Cuba may also ask for restriction whenever 60 per cent. of the producers representing 60 per cent. of the production agree on it voluntarily before November 1st. The size of the crop is to be fixed before February 1st while the harvest is on. The C.E.N.A. directors may request that presidential decrees be issued to carry out any resolutions that they may decide on.

A tax of eleven cents per bag of sugar produced is to be levied during each of the next five years; this is to cover interest and other charges on the bonds. The tax is to be increased to 50 cents per bag for the five subsequent

years in order to provide for the amortization of the bonds. These taxes are subject to revision up or down as may become necessary. Limitation of number of bags produced will naturally lower the revenue from this source and necessitate corresponding changes.

It is understood that charges for storage, depreciation, insurance, losses in weight and polarization and warehouse handling, amount to 0.02 cents per month or $5.4528 per long ton Sp. per year. The following accumulation of expenses may result from the holding of 1,500,000 tons of sugar for the five-year marketing plan.

Amount of Sugar. Long Tons Sp. Wt.	Crop Year.	Expenses.
1,500,000	1930-31	$8,179,200.00
1,200,000	1931-32	6,543,360.00
900,000	1932-33	4,907,520.00
600,000	1933-34	3,271,620.00
300,000	1934-35	1,635,840.00
Total storage expenses		$24,537,600.00
Total Bond Interest 5½ per cent		11,550,000.00
Total charges		$36,087,600.00

The total expenses will then average $23.72 per ton av. as compared to the price of $24.64 received by the producer, to which may be added the port charges paid by the producer giving a total amount of $51.77 per long ton av. that must be recovered by the C.E.N.A. before its costs can be surmounted or 2.31 f.o.b. per lb., say 2.45 c. & f. New York. If the producer is to break even, the price received would have to be at least three cents c. & f. N.Y., since the price of 1.10 is at least 0.55 under his costs. In the light of these data the assertion by some experts that this plan was developed to lift the great weight of mortgaged sugar from the Northern banks seems reasonable. They stood to suffer a tremendous loss at the low prices ruling before the plan was assured of Cuban legislative support. This risk has now been transferred to the producers with the assistance of the Cuban Government; the certificates received by the holders for their sugars entitle them to participate in any profits earned by the C.E.N.A. in the marketing of the sugars. The 11 cent and later 50 cent per bag taxes obligate him to share in the expenses, so that the producer will be unable to call his soul his own during the life of the present law. How long it will actually last, no one knows. Previous organizations have had a short life, but the financial obligations incurred and the absolute control given to the President and the C.E.N.A. may assure its continuance.

The law authorizes the President to limit exports to the United States or to any other market during the next five years. It is understood that the portion allotted to the U.S. in 1931 will be 2,800,000 long tons, Sp. It is possible that the International Conference to be held within the next few weeks will restrict the exports from Cuba to other countries to 700,000 tons or less. This would indicate a crop to be made in 1931 of 3,500,000 tons as compared to 4,671,000 in 1930. The crop has been set to start January 15th, 1931. At least ten dollars circulates in the country for each ton of sugar made, in the form of wages, etc. It is difficult to imagine the results of a further decrease of ten million dollars in the 1930 labourers' income.

Messrs. Viriato Gutierrez, Tarafa, Gomez Mena, Lopez Ona and Chadbourne, have been delegated to meet the European and Java sugar producers about the first of December. Restriction of the Java 1931 crop seems impossible, but some segregation plan may be worked out to remove a

certain quantity from the world market for a period of years similar to the Cuban plan. The Conference will probably decide on an allotment of exports to each producing country and allow the size of the crops made to harmonize with this figure.

Apparently consumption has faded from the picture and it is doubtful whether efforts will be made to increase the use of sugar. It is probable that many European industries are using saccharin in their products instead of sugar. If the International Conference would call on each Government to limit the use of this drug to medicinal purposes it is probable that a large increase in the use of sugar could be thus obtained. There are doubtless many other hindrances to advancing sugar consumption that could be cleared up if given proper attention.

A new law has been passed by Congress imposing a tax of $1.00 per 100 arrobas of cane (2500 lbs. Sp. wt.) on any increase in administration cane in 1931 over 1930. This is aimed to prevent mill owners taking over colono cane due to financial stress. It has not been signed by the President.

Economic Conditions in the Japanese Sugar Industry.[1]

(Department of Overseas Trade Report.)

Japan.

Sugar Refining and Confectionery.—Exported products of the sugar refining and confectionery industry in 1929 were valued at Yen 31,852,362, a decrease of Yen 8,501,757 as compared with 1928. In 1926 and 1927 exports were valued at Yen 36,556,000 and Yen 31,252,000. The markets supplied are China and Manchuria and Asiatic Russia, where conditions are unstable.

The sources of supply of the raw sugar for the Japanese industry are Formosa, the Dutch East Indies, Cuba and the Philippine Islands, and the following figures will show (1) how Japan has increased the production within her own territory and (2) reduced imports from abroad :—

(1) *Formosan raw sugar shipped to Japan.*	Piculs.	(2) *Raw sugar imported.*	Piculs.
1926	7,487,915	1926	7,568,820
1927	6,928,384	1927	7,022,826
1928	9,768,000	1928	6,350,938
1929	12,385,000	1929	3,795,281

The Formosan sugar crop is now large enough to supply all the sugar needed for home consumption in Japan, though not yet large enough to allow also for Japan's exports of refined sugar. Production in Formosa, however, is at present developing faster than consumption in Japan, and it must presently be decided whether Formosan raw sugar can economically replace imported raw sugar for use in the refineries producing for export. At present the cost of production of raw sugar in Formosa is some 30 per cent. higher than in Java ; but methods of reducing costs in Formosa are being considered.

Formosa.

Sugar.—Sugar very easily maintained its place at the head of the exports list for 1929. Virtually the entire output is taken by Japan, and shipments

1 Abstracted from " Economic Conditions in Japan to 30th June, 1930," as prepared by H.M. Embassy, Tokyo, for the Department of Overseas Trade. H.M. Stationery Office, London. 2s. 6d. net.

to that country during the year amounted to 12,385,000 piculs valued at Yen 142,601,000, an increase of some 2,700,000 piculs over the record figures of the preceding year.

The area planted with cane and the production of sugar during the past three seasons are shown in the following table :—

Season.	Area. Acres.	Production. Tons.
1926-27	296,245	395,900
1927-28	238,259	562,144
1928-29	258,700	764,906
1929-30 (estimated)	236,865	787,650

The above figures bear eloquent testimony to the steady increase in production. This increase, despite the diminution in planted area which has taken place concurrently in recent years, demonstrates the success which has attended the introduction of more advanced methods and more modern machines, as well as of the wider use of superior varieties of cane.

In view of the over-production in other parts of the world and the fact that Japan has now attained her objective of virtual self-sufficiency in the production of sugar, it is hardly likely that recent rates of expansion will be maintained in the 1930-31 season. Unless Formosan sugar can be grown to compete with the Java product in foreign markets—and the discrepancy in price is still very considerable—the limit of useful output has probably been reached for the present. As a first step in lowering the cost of production, it has been proposed by the sugar companies to reduce the price paid to growers by one yen per 1000 kin for the coming season. Owing to the abnormally low cost of fertilizers at the present time, and the greatly improved yields obtained from the cane now being grown, it is claimed that no hardship to farmers will result and that the acreage under cane is unlikely to suffer much reduction in consequence. It may be noted, however, that weather conditions have been unusually favourable during the last five years, and that recent comparative immunity from destructive typhoons cannot be expected to continue indefinitely.

If sugar companies are to continue to thrive with sugar around present prices, attention must be paid to the development of by-products. Thus we find the production of molasses keeping pace with that of sugar. By far the greater proportion is at present used in the manufacture of industrial alcohol, but out of a total production of 330 million kin, some 70 million kin, valued at Yen 705,000 were exported during 1929, of which 66 per cent. were shipped to Japan and Corea. This represented a rise of 92 per cent. in quantity and 77 per cent in value over the export figures of 1928. In view of the provision of improved facilities for transport and storage on land, and for shipment by sea, the export of this by-product of sugar may be expected to show expansion during the next few years.

Alcohol.—Estimated production for the 1929 season (1/3/29 to 28/2/30) was considerably above the figures actually realized, the export to China being adversely affected by the rise of the yen and the fall in silver, while a tendency developed to ship molasses abroad in preference to utilizing it for manufacture of alcohol in Formosa. The output actually realized amounted to 32,599,500 litres—an increase of 1,654,500 litres over the figures for the previous season. Alcohol is manufactured almost exclusively for export, some 60 per cent. of the output generally finding its way to China, and 40 per cent. to Japan.

Dilution in Relation to Comparative Purities.

By NOËL DEERR.

In *Facts About Sugar* for June, 1930, an article "Dilution in relation to comparative Purities," due to Mr. HAYWARD G. HILL, is to be found. In this article exception is taken to a procedure adopted by the Hawaiian Sugar Technologists' Association and particularly to a statement to be found in their official methods : "*To be strictly comparable, gravity solids determination should be made in solutions of the same non-sugar concentration.*" Of this he remarks : "The italicized sentence is correct only for products in which the ratio of total sugars to total non-sugars is the same, but does not hold when this ratio has been changed."

The present writer was responsible for the adoption of the procedure to which objection is made and consequently feels justified in appearing as counsel for its defence. The object of determining in equal concentration of non-sugar the degree Brix or gravity solids of inter-correlated juices, syrups and molasses is to obtain a means whereby gravity solids may be substituted for absolute solids or dry substance in the determination of purities used in the *sjm* control equation and also in the construction of gravity solids balance sheets. The reasoning, upon which this procedure stands, follows :—

In a process in which sugar is removed from an impure material the relation between sugar recovered and the purities of the materials is given by the expression :—

$$\text{Sugar recovered} = \frac{s\,(j - m)}{j\,(s - m)}$$

where s, j and m are the purities of the sugar recovered, the original impure material and the residue or molasses ; when the value of s is 1 or when pure sugar is produced, this expression reduces to :—

$$\frac{j - m}{j\,(1 - m)}.$$

When the purities are referred to dry substance or are absolute purities, no difficulty in the use of the expression obtains. Owing, however, to the non-sugars possessing a solution density factor very different from that of sugar, values of the solids as deduced from the degree Brix, or what the writer has called the "Gravity Solids," cannot be used independent of the concentration at which the determination is made.

Now let there be w dry matter in a juice whence k sugar is removed, leaving $w - k$ residue dry matter.

The expression given above may then be written in the form :—

$$\text{Sugar recovered} = \frac{\dfrac{s}{w} - \dfrac{s-k}{w-k}}{\dfrac{s}{w}\left(1 - \dfrac{s-k}{w-k}\right)}$$

$$\text{which reduces to } \frac{k\,(w - s)}{s\,(w - s)} = \frac{k}{s}.$$

If however, degree Brix or gravity solids be used, in the term referring to juice $(w + a)$ will appear in place of w, and in terms referring to residue or molasses $w + a^1$ will appear in place of w. If the determination be made in equal concentration of non-sugar it is evident that $a = a^1$ and accordingly

Dilution in Relation to Comparative Purities.

$$\frac{\frac{s}{w+a} - \frac{s-k}{w+a-k}}{\frac{s}{w}\left(1 - \frac{s-k}{w+a-k}\right)}$$

which similarly reduces to $\frac{k}{s}\left(\frac{w+a-s}{w+a-s}\right) = \frac{k}{s}$.

In case the reasoning above is not clear a numerical example is given.

Let there be a juice containing 10 per cent. sugar and 1 per cent. non-sugar and let the 1 per cent. non-sugar give a reading of 2° Brix. Then the absolute purity of the material is $\frac{10}{11} = 0{\cdot}90909$ and the gravity purity is $\frac{10}{12} = 0{\cdot}83333$.

Let sugar be removed until the residue is of 0·4 absolute purity.

The gravity solids in the residue will then be :—

Due to non-sugar		2·00000
Due to sugar ..	$\frac{0{\cdot}4}{1 - 0{\cdot}4}$ =	0·66667
Total		2·66667

The gravity purity of the residue will be $\frac{0{\cdot}66667}{2{\cdot}66667} = 0{\cdot}25000$.

Using absolute purities the sugar recovered appears as :—

$$\text{Sugar recovered} = \frac{0{\cdot}90909 - 0{\cdot}40000}{0{\cdot}90909\ (1 - 0{\cdot}40000)} = 0{\cdot}93333$$

and using gravity purities :—

$$\text{Sugar recovered} = \frac{0{\cdot}83333 - 0{\cdot}25000}{0{\cdot}83333\ (1 - 0{\cdot}25000)} = 0{\cdot}93333.$$

The above reasoning also will serve to demonstrate that an accurate Brix or gravity solids balance can also be made when non-sugars are determined in equal concentration.

The identity of the values obtained from the use of absolute and gravity purities shows what is meant by the use of the word "comparable" in the official Direction of the Association of Hawaiian Sugar Technologists. There may, however, be some confusion in the meaning to be applied to the word "comparable." Mr. HILL points out "at lower concentration the error caused by the non-sugars is greater than at higher concentration" and in one sense his remarks regarding the ratio of sugars to non-sugars are justifiable. This sense is, however, remote from that in which it is used in the procedure to which he has taken exception.

ALCOHOL MOTOR FUEL.—In Brazil the Government is being urged by experts to assist in the production of alcohol motor fuel containing petrol on the same lines as is done in France with her national carburant where all petrol must be sold in admixture with alcohol. But it is necessary that absolute alcohol be used in order to obtain proper admixture, otherwise one must add ether, benzol, or the like, which adds to the cost of the fuel. However, absolute alcohol is now being manufactured at no greater cost than for 95/96 per cent. spirit.[1] Surplus cane would be used in Brazil as the raw material for this production.

[1] *I.S.J.*, 1930, 77.

The Jamaica Sugar Industry.

Department of Agriculture Report for the Year 1929.

According to the Annual Report of the Jamaica Department of Agriculture, 1929 was on the whole a good year for Jamaica, but this result was admittedly mainly due to the expansion of the banana trade. Sugar, however, did better than might have been expected with an export record of 37,380 tons, valued at nearly half a million pounds. Most estates covered expenses or made a small profit due to improved cane yields. Towards the end of the year the sugar crisis came to a head and the Legislature had to take prompt measures to secure temporary relief by arranging for a bounty of £2 per ton for all sugars exported, and for an equitable allocation of the profits arising from the small but protected local market for grocery sugars. This financial crisis came at a particularly unfortunate time because the planters had been making marked strides in the cultivation of improved canes, in deep tillage, irrigation, the use of lime and fertilizers, whereby greatly improved canes were being obtained. As for rum, its production is being kept as low as possible by the estates owing to difficulties of sale. The high-flavoured rums were in good demand and some satisfactory prices were obtained. Ordinary rums were slow of sale and the prices low.

Owing to the low prices obtained for sugar during the past three or four years, planters are turning their attention where possible to banana cultivation and the area under bananas is steadily increasing year after year. This is particularly noticeable in the Vere district which is one of the best sugar cane growing areas in the island. Here irrigation arrangements are being made to supply over 3000 acres of the fruit. Owing to such a large acreage reverting from canes to bananas the total output of sugar will be materially reduced. In St. Thomas where a large and up-to-date sugar factory, worked by electricity, was erected about four years ago, it has been found more profitable to grow bananas than sugar cane at the present price of sugar, and the proprietors are also turning their attention to growing bananas on a small scale with the hope that better prices will be obtained for sugar in the future, when these lands will be put back into sugar cane. In Trelawny where the soil is not suitable for growing bananas, nor is the rainfall sufficient, the estates can only carry on through the good prices which they receive for their special rum.

Mosaic.—Mosaic is being steadily fought year after year, by systematic rogueing and planting of highly resistant varieties, but apparently in some years the climatic conditions favour the sudden outbreak of this disease when it is thought that the disease is under control. This is most noticeable in districts where there is a good rainfall, and planters are afraid to plant extensively any good variety which is susceptible to the disease, although it would double their tonnage per acre, owing to the cost of continual rogueing and replanting and never having their fields well established.

In Westmoreland, the planters endeavour to do all their planting during the fall of the year, as they have discovered that canes planted at this time of the year do not develop the disease to any extent, while those planted during the Spring develop anything between 20 per cent. and 30 per cent. disease. This was very noticeable on one estate, where two fields of BH 10 (12) were planted side by side, one in October, and the other in April. In the field planted in October, it was hard to find a diseased cane, while the other had an infection of about 40 per cent. The ratoons growing from canes which are reaped during the Spring are always heavily infected, although the past crop

on the field had little or no infection, and every succeeding ratoon crop is more heavily infected. This would suggest that the carrier of mosaic virus is either dormant during the fall of the year, or that it is passing through some stage in its metamorphosis which hinders its being an active invector.

POJ 2725, which is highly resistant to mosaic, has been a most valuable asset in this respect, in that where heavy infection prevails, it has been possible to replant the fields or areas with this variety, and so reduce the area of actually infected cane on the estate. This cane is now being used in infected areas in preference to the Uba as it is much easier to handle and costs less to cut. POJ 2727 is also a very promising variety, but unfortunately its resistance to mosaic is not so pronounced as that of POJ 2725. Still it was remarkable during the early part of 1929 when the drought was very severe to see how this variety persisted in going ahead while other varieties were at a standstill and some dying out for want of water.

Again this year there has been a marked increase in root disease, particularly in the variety BH 10(12) and in most cases this was due to lack of proper drainage and unsuitable soil conditions. So far Pokkah-Bong has not been evident in Jamaica although it is present in the neighbouring island of Cuba. Gummosis also has not yet been recorded; and it is hoped that both these troubles will be prevented from invading Jamaica by the rigorous enforcement of the plant import regulations.

Canes.—The BH 10(12) and Ba 11569. continue to give good results, and some places have averaged over 45 tons per acre for plant canes. In Vere the Ba 11569 in several instances has exceeded 60 tons per acre. This is a remarkable increase over the White Transparent, which seldom gave 30 tons per acre as its highest tonnage, and it is regrettable to see from statistics gathered during the year, that out of a total of approximately 27,000 acres under canes, the White Transparent claims 7339 acres, or approximately one-quarter of the area under canes, while the BH 10(12) cover 7633 acres and Uba 6644. Both the Ba 11569 and BH 10(12) are being gradually extended where conditions are suitable and the POJ 2725 is gradually taking the place of the Uba. The SC 12/4 is very promising, and it is being rapidly extended; some places expect to reap over 60 tons per acre from this cane during 1930, while others have already obtained 55 tons per acre.

The EK 28 is a very promising cane in the Vere district. This cane has averaged 78 tons per acre from a field recently reaped. From observation it is apparent that in the Vere district it is not very susceptible to mosaic disease, while in other districts it is badly affected.

It is very noticeable that on those estates where mechanical cultivation is in practice, a much better tonnage per acre is obtained than on estates where such cultivation is not used, the practice of mechanical cultivation not being possible in some places owing to the conformation of the land.

CARBON IN DIOSEK S.F.—At a meeting of the Verein der slowakischen Zuckerindustrie held at Pressburg recently, Dr. Wohryzek delivered a lecture on "The Decolorizing Carbon Process in the Diosek Sugar Factory." For the first time, particulars were given of the routine work of a refinery which had closed its bon char house and entirely replaced the char by activated carbon. Dr. Wohryzek clearly presented the new method of working and its advantages, illustrated by drawings, diagrams and figures. The discussion following the lecture spoke well for the interest this lecture had aroused. Mention was made of an Austrian refinery which had likewise replaced its bonechar by the Norit process with the best results. It would seem therefore that one may now look forward to the future development of the carbon refining industry.

Recent Work in Cane Agriculture.

THE DRAINAGE PROBLEM IN THE IMPERVIOUS CLAY SOILS OF CUBA. **R. Menendez Ramos.** *Proceedings of the Annual Conference of the Asociacion de Tecnicos Azucareros de Cuba.* December, 1929.

In this long paper the author, assisted by a great number of photographs, describes what he calls the semi-grand bank system of surface drainage which he has found to be effective and economical in heavy clay soils on the plantations of eastern Cuba. In his historical introduction he points out that in most sugar cane countries the importance of draining the fields has long been recognized ; and the grand bank system of Porto Rico where drains are dug in the alternate middles, and the Louisiana system where the furrows alternate with the cane rows have been practised for very many years. But in Cuba very little attention has been paid to this class of work, a possible reason being, as EARLE has suggested, that the planters learnt their cultivation practice on the peculiar red clay of the Matanzas province, which is characterized by very perfect natural drainage. But the principle is not new in Cuba, for seventy years ago, REYNOSO, while mainly relying on deep ploughing, subsoiling and even tile draining and the use of fertilizers for drainage, also recognized the possibilities of surface drains in low lands. He suggested the formation of a series of long strips or "lands," separated at intervals of 20 to 40 metres by parallel trenches to collect the water from heavy rains, with cross ditches as needed to carry off the water from them. In recent years the great expansion of the industry in the east of Cuba has brought the planters up against heavy clays which, while rich in plant food, are impossible to improve by deep ploughing or breaking the subsoil, and which obviously need some form of surface drainage. These soils in great part belong to the Bayamo series, low black lands of hogwallow type.[1]

The author's first experience with Cuban soils of this type occurred in 1924. He noted repeatedly that the canes growing on the low flat lands were everywhere in difficulties, while those on the slightly higher neighbouring fields or parts of fields were quite healthy, although analysis proved that they were not supplied with any greater amounts of plant food. When, then, he had to lay down a three acre nursery on low, flat land, he decided to prepare it on the grand bank system of Porto Rico. But he quickly found that the cost of digging the deep trenches by hand labour, as is done in that island, was prohibitive when done with the highly paid labour of Cuba. He therefore made use of bull ploughs and tractors drawing Martin ditchers, and prepared banks carrying four, instead of two rows of cane as is the rule in Porto Rico. And this proved perfectly successful. After testing the new system on several estates under his charge, he recommends its general adoption for the heavy low-lying lands of Cuba ; for he considers that very few of them need the closer ditching usual on the low *poyal* lands in Porto Rico ; and he termed this variation of the method the semi-grand bank system. No fear need be entertained as to the cost of this drainage ; for "everywhere, working with implements has brought down the cost of ditching to between one fifth and one-tenth of the old pick and shovel method."

The author then proceeds to describe his method in considerable detail, in a series of numbered paragraphs, emphasizing the various points to be remembered in applying it, of which the following have been extracted. The drains and planting furrows are to be laid out parallel to one another and in the direction of any slight fall in the land, that is, in exactly the opposite manner to contour planting where they are arranged across the fall. Whether using bulls or tractors, the drains should be marked out beforehand by lines of

[1] *I.S.J.*, 1930, 525.

stakes, 23 to 24 ft. or more apart, according to the number of furrows and the closeness of the rows to be planted on each bank, and also dependent on the natural soil moisture and depth of water table. The system is very elastic, but few lands in Cuba require less than four rows per bank. Begin ploughing along the centre of the bank, constantly throwing the soil towards this centre line, so that the dead furrow at the side of the bank will coincide with that of the next bank. Open the drains with a 20-A Martin ditcher, or double mouldboard plough or lister, moving up and down till the proper depth is reached. If the run off is affected by irregularities, these must be corrected by hand labour

Put in four, six or more furrows to each bank according to plan, being careful not to make them too deep; a depth of 5-6 in. is usually all that is needed and can be well and cheaply made by 7-8 in. ploughs. No cross ploughing should be done but, if needed, second ploughings and harrowings should travel in the same direction as the first ploughing. When steam ploughs or STORY'S gyrotiller are used, ploughing will have to be done on the flat, and the trenching will follow with certain variations in treatment; and the same alterations will be necessary where cross ploughing is needed because of *Parana* grass.

The seed should be cut short, usually with three buds, leaving the odd parts of the internode attached: it should be placed by pick in the bottom of the furrow at an angle of 45° or, in very wet land, erect. The reason for this is that both wet and dry periods are commonly met with in this part of the island and these should be guarded against: during the former the upper bud will have free air and not be water-logged, and in the latter the lower bud will be in contact with moister soil. Quarter drains and cross ditches will be required if the banks are too long or if there are sags in the field level, but they should be reduced as much as possible, because of interfering with the cultivation along the rows. Additional ditches should be placed at the upper end of the field to guard against run off from the neighbouring fields, and the lower ends of the ditches and furrows should be kept well opened so that no stagnant water lies at any time.

Merely covering the sets with hoes or ploughs is a poor and hazardous practice for, in the case of any sort of drought immediately after planting, the germination will always be very poor and in many cases a total loss. Pick planting of the cuttings at an angle of 45° or so, with the furrows left open for gradual filling during the subsequent cultivation, is a much safer proceeding, especially in early spring or late fall plantings. When it comes to the cultivation of these semi-grand bank fields as ratoon cane, the advantage of such a system of drainage will be self evident. The trash can be lined in alternate rows and the clean middles given adequate cultivation, always running in one direction and with a minimum of interfering cross-ditches. Inter-bank drains and most other ditches can be cleaned well before the spring rains start, and the field be thus kept properly drained for successive seasons This can be done easily and cheaply by removing the trash by hand, and passing through the old ditch a Martin grader or large double mould-board plough, preferably the former. Once the cane is up, flat cultivation can be given on top of the banks with pony ploughs and cultivators as usual.

Details of the cost of drainage by semi-grand banking are given, as rarely exceeding $150 per caballeria (33·3 acres), the general average for the past season in Oriente province having been nearer $100; and in one case 8 caballerias were very satisfactorily ditched at $85, including cleaning the main outlet ditches, and blading the alley ways or *guardarrayas*. The V-shaped

ditches made by the Martin ditcher do not seriously interfere with the work of mules and tractors, and do not fill so easily with earth in rainy weather as the hand-made straight-sided ditches of grand bank. If tractors are used, ample space (12-15 ft.) should be left at the ends of the rows for turning them round. Cases are given of the increase in yields by the methods described in this paper; in two instances the tonnage was 100 per cent. greater; and in others, where fields had failed disastrously through waterlogging, they yielded quite handsomely after installing the system.

So far as the author knows, there is no other alternative for handling these heavy black lands. Tile drainage is out of the question, and mole draining and knifing would be of little use, because of the extreme plasticity of the sub-soil; the hilling of Louisiana is not adaptable for long ratooning, and would suffer too much from the winter droughts in the tropics. Liming the soil, while improving the top soil, cannot be expected to increase percolation in the sub-soil to prevent water-logging; and "the futility of fertilizer applications in these heavy black lands of Cuba is well known to all of us." "In these soils, lowering the water table and supplying at the same time quick outlets for any excess of superficial moisture, is the only road to fair crops and reasonably long life of the ratoons." Diagrams are added of sections to scale of a nine-foot grand bank with two rows of cane with square drains 12 ins. deep, and of a 24 ft. semi-grand bank with four rows of cane and V-shaped drains reaching 15 ins. at the deepest part.

THE BEHAVIOUR OF THE NEW POJ CANES IN RELATION TO SUGAR CANE MOSAIC IN CUBA. **C. F. Stahl and J. A. Faris.** *Tropical Plant Research Foundation, Bulletin* 19, 1929.

The authors consider that the new POJ numbers 2714, 2725, 2727 and 2878 are of special interest because of their resistance to mosaic in places where this disease spreads rapidly, as substitutes for good but susceptible varieties, and this especially so because in such places roguing is difficult and not economical. The studies on POJ 2883 and 2878 are less complete than the others because of their later introduction. A chart is printed showing the derivation of these canes.[2]

In order to secure definite information as to the relative susceptibility of these and the standard and other canes, they were planted in double rows alternating with Cristalina infected with mosaic (POJ 2878 is not in the list), with a row of healthy Cristalina as control. Counts were taken of the infected stalks at 5, 6 and 7 months and the results are given in a Table. At 5 months all excepting POJ 2727, 2725, and 2714 were infected to 60-90 per cent., while the figures for these three varieties were 16·3, 12·9, 11·6 respectively. Infection showed a general increase at 6 and 7 months, except in POJ 2714, its figures for the three periods being 11·6, 16·3, and 7·0; this irregularity was traced to the recovery of four plants in the POJ 2714 rows. And similar recoveries had been noted in 1925: the individual mosaic stalks died, but when the plants were cut back and ratooned, the newly-grown plants were normal. POJ 2725 planted at the same time showed well marked mosaic symptoms, but the diseased stalks grew equally well with the healthy ones, and no symptoms were observed in the 1st, 2nd or 3rd ratoons.

A further experiment consisted in inoculating seedlings 3-6 in. high with 50 *Aphis maidis*, previously fed for two days on mosaic plants, under controlled cage conditions. The percentages of successful inoculations were: POJ 2883, 100; 2725, 26·6; 2714, 8·69; 2727, 8·33; and 2878, 0·0; while POJ 36, Badila, BH 10 (12) and Cristalina varied from 68·4 to 84·6. Infected plants of

[2] See *I.S.J.*, 1927, page 66.

POJ 2714, 2725 and 2727 were transplanted and kept under observation. The leaf mottling was "quite distinctive when compared with Cristalina." One case of POJ 2714 was noted with symptoms in the leaves; the symptoms disappeared, and the ratoon stalks appeared to be normal. Conspicuous cankers have never been seen in these three varieties. Dwarfing and shrinking were especially noted in POJ 2714, the stalks being so severely injured that they died in a comparatively short time; while the stalks of mosaic plants in POJ 2725 and 2727 appeared to be quite healthy.

Further observations on stools and ratoons tend to show that the behaviour of mosaic is less virulent in these three varieties than is usual: the disease is often confined to certain stalks or even buds on them, and when they die the disease tends to disappear from the stool and healthy ratoons are produced. This behaviour suggested that the virus might have undergone a modification while passing through the POJ plants; but re-inoculation on to Cristalina from which the virus was obtained, by *Aphis maidis* again, failed to support this suggestion.

THE CONTROL OF *Diatraea saccharalis* IN BARBADOS BY MASS LIBERATION OF *Trichogramma minutum*. **R. W. E. Tucker.** *Tropical Agriculture*. November, 1929, 224 and 1930, 292.

In reviewing a recent paper on the Natural Enemies of the Moth borer in Cuba, attention was drawn to the remarks of the author on the inefficiency of the control effected by *Trichogramma minutum*, its egg borer parasite.[1] In egg masses collected during two five-month periods in 1928 and 1929, on the cane fields of 16 centrals, the average of egg masses invaded was only 31·7 per cent., and in one of the egg masses only a single egg was parasitized. And the general conclusion arrived at was that the work of *Trichogramma minutum* had been over-estimated. That this is undoubtedly true, in nature, is evident from recent studies in Barbados, which, however, indicate clearly the latent power of this parasite, when properly studied and suitably encouraged.

TUCKER observes that in Barbados there appears to be normally a state of equilibrium between the moth borer and this parasite, and by the end of the season the latter exerts at least a 90 per cent. control on the pest. Thus, at one time of the year, both host and parasite are reduced to a minimum as to numbers. After this period, however, everything is in favour of the borer's increase; and considerable damage is done by it before the parasite is able to obtain the necessary food for rapid multiplication, that is, food provided by the eggs laid by the mature insects, after the immature stages, or grubs, have wrought their havoc on the canes. The object aimed at in the work is, therefore, to maintain a continued concentration of the parasite at all times of the year, and especially at the commencement of the season, so as to establish an early supremacy for it. The period of growth from egg to flying insect is, in *Trichogramma* from 8 to 9 days, while it is 30 to 31 days in the borer; and this may also re-act adversely on the parasite, because of a lack of food between the first and second broods of the mothborer. Given plenty of food the parasite increases much more rapidly than the borer; and hence presumably its supremacy at the end of the season. Such being the case it is not surprising that, in nature, the parasite may have little effect in control; and this is especially the case where the young fields of cane are planted, as they invariably are in Barbados, close to badly infested old canes.

These various difficulties have been overcome in Barbados by adopting the method employed first by FLANDERS in California (and subsequently introduced into Louisiana) of raising masses of *Trichogramma* in the laboratory

[1] *I.S.J.*, 1930, 418.

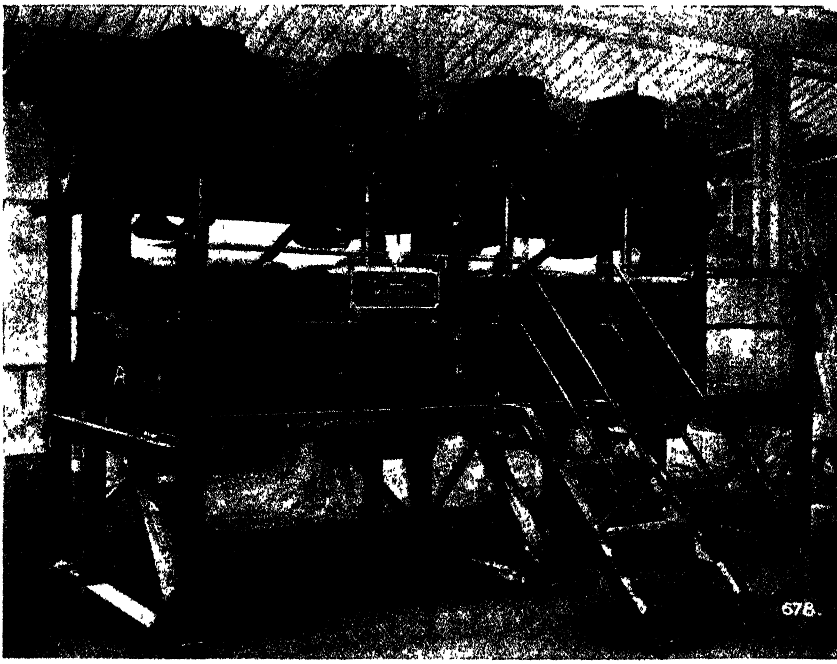
on the eggs of the grain moth, *Sitotroga cerealella* which it also parasitizes, and introducing them into the cane fields at any desired time of the year. These moths (obtained from Louisiana) are reared in specially constructed breeding boxes, and then parasitized by a complicated technique suited to the climatic conditions in Barbados. The eggs of the grain moth are collected by an ingenious device, cleaned and dusted on to sheets moistened with gum arabic; and the sheets when dry are exposed to *Trichogramma*. By this means a uniformly 8-fold reproduction of the parasite has been effected. The sheets of parasitized eggs are standardized as to the number of eggs they contain, and then cut into slips for ready use, and then placed in containers, each holding 12,000 eggs. The containers are distributed to the planters with full instructions as to their use, it being understood that the parasites will hatch out 24 hours after they have reached the planters. It is estimated that each container with its 12,000 eggs will serve for 15-16 acres of cane; and a diagram is sent with each distribution illustrating the particular method to be adopted, i.e., placing one slip on each clump, arranged in the field on a chess-board pattern. All distribution bears in mind the direction of the prevailing wind, and the passage of the surplus if any to neighbouring fields or estates.

The total number of parasites liberated during 1929 was about 23 million, and the largest number in any one month over 6 million In 1930 it is hoped that 50-60 million will be distributed, with over 10 million in each month during which distribution takes place. The aim held in view is to secure a fairly uniform and continuous distribution to cover the entire island once every three weeks, that is during the 5 or 6 months when distribution is considered necessary.

The results derived from the limited distribution of *Trichogramma* in 1929 are assessed as follows: (1) A Table shows the estimated complete loss of canes through borer in the fields of four factories during the 1929 and 1930 seasons; also the total numbers of canes badly bored and untouched; and the average weights of canes being crushed at four mills—2500 canes being weighed in 1929 and 5000 in 1930. Loss in field, 31 per cent. in 1929 and 20·85 per cent. in 1930: badly bored canes, 55 per cent. and 19 per cent.: untouched canes 9·5 per cent. and 27·5 per cent.: weights of individual canes, 4·05 lbs. and 4·77 lbs. As to the latter it is pointed out that other factors may have assisted, e.g., a partial control of root borer, *Diaprepes abbreviatus*. (2) Randomized counts of borer egg masses on the leaves, and their proportional attack by *Trichogramma*. The collections were made in certain sections of fields at fortnightly intervals by the author during 1928 and 1929, each visit lasting one hour. Nearly 50,000 eggs were examined in 1929, and the collection was less standardized in 1928; but the results of their examination showed an increase of parasitism of 11·1 per cent. in 1929 over that in 1928.

(3) In addition to counts and weighings of badly bored, slightly bored and untouched canes made in five factory yards in different areas of the island, 100 lb. bundles of each class of canes were sent to the laboratory for further analysis. This analysis showed that 38·5 per cent. of the joints were affected by borer. The bored joints were cut out and separately analysed as to purity and sucrose content, the results being: unbored joints 88·12 and 19·66, and the bored joints 86·29 and 18·39. The date of this experiment is not clearly given, but it would appear to have been conducted in 1930; for the author draws the conclusion after giving these figures, that, although the managers were fairly unanimous that borer was much less and purity and sucrose higher in 1930 than in former years, the loss of sugar is still a considerable item.

The hindrances and sets back to mass breeding of *Trichogramma* are set out in some detail, the most serious being the presence in the breeding



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cages of a predacious mite destroying moths and eggs, a parasite on the moths reducing their egg laying, and the moth *Ephestia* which devoured the eggs on the sheets. These pests were being got over and it was anticipated that, by thoroughly overhauling the cages these and other hindrances would be obviated in the 1930 campaign.

As future measures, are mentioned the securing of borer-free planting material as a regular plantation routine practice, and the liberation of 10 to 12 million parasites at least during six months of the year, with due regard to assistance that may be rendered by *Loxiphaga diatraeae* which has been introduced from Cuba. The cost of these control measures is carefully examined, and it is calculated that for ensuring borer free planting material and for the breeding and liberation of *Trichogramma*, including the salary of a competent assistant, the expenditure would not in all exceed £400 a year, that is, 3d. per acre of cane in the island.

PRE-HARVEST SAMPLING OF CANE. **F. W. Broadbent.** *Reports of the Association of Hawaiian Sugar Technologists.* October, 1930.

The object of this practice is the location of fields of ripe cane, and the effort will be justified if it results in reaping the canes at their maximum sugar content. In order to obtain an idea as to how far the practice extended in the Hawaiian Islands, a brief questionnaire was sent to 42 plantations, and replies were received from 27. Of these, 19 took samples, 6 regularly and 13 only occasionally. Ten plantations selected stalks, one sampled car loads, six both car loads and stalks, and two took stool samples. Seven claimed that the practice prevented them from harvesting over-ripe canes, two were uncertain, and ten felt that they derived no benefit in this respect. All made complete analysis : Brix, polarization, purity, and quality ratio. Leaf colour was regarded as significant by nine, not so by three, while four considered it unreliable. This would undoubtedly be influenced by the variety grown, and five of the first nine grew H 109. In the plantations which had used pre-harvest sampling for several years and expressed an opinion, advantage was claimed by about half. Replies were also received from the Virgin Islands, San Domingo, Porto Rico and Egypt ; and all appeared to be fully satisfied with the benefit derived from sampling, one of the replies stating that samples were taken "from each and every car going to the mills."

In conclusion, simple definitions are given of the terms used to express the laboratory results : Brix, polarization, purity and quality ratio, with various implications as to conditions in field and factory. Purity expresses the ratio between sugar and other solids in a solution, is in fact the per cent. of Brix which is polarization ; and is not therefore affected by addition of removal of water from the solution. Quality ratio or cane ratio is the expected number of tons of cane required to produce one ton of sugar, based on the analysis of the juice, with an assumed set of mill conditions. A high Brix and purity, resulting in a low quality ratio, would indicate the most desirable condition of cane for harvesting. A low Brix with comparatively high purity might be found in wet weather. Here the quality ratio might be due to excess of water in the cane, and the purity would be the proper guide to the most favourable cane to harvest. High Brix and low purity might indicate dried up cane, or cane that is "going back." From all this it is obvious that a knowledge of the general conditions in the field is needed for the application of the laboratory results to harvesting the cane. C. A. B.

The Sugar Losses of Beet Sugar Manufacture.

By H. CLAASSEN.

(*Continued from page* 581.)

Determinable and Undeterminable Losses.

As determined losses, one counts in practice only those the quantity of which can be determined. Determinable losses in this sense are only the losses in the by-products and waste-waters of juice extraction and juice purification, as well as in the hot-well waters. Their weights can be ascertained directly or by calculation accurately enough, and one can also obtain good average samples of them for examination according to their percentage content.

Losses which cannot be determined by the usual methods of sampling and examination fall into three classes : (*I*) Those which could be determined with improved sampling or more accurate analytical methods. (*II*) Those, the quantity of which cannot be determined, but for which a cause can be assigned ; and those which so far cannot be determined, nor can be explained.

(*I*) Losses which could be determined by Improved Methods.

A—Sampling.

(1) The sampling of fresh slices can give rise to marked errors when negligently carried out, or when samples which are too small are taken. It is immaterial whether the sample be taken from the slicing machine or when filling the diffusion vessels, as the slices do not dry up in transit from the slicing machine to the diffusers, nor do they take up water. To the contrary when average samples are taken, a slight drying up can occur even when the container is kept well closed. It is difficult to avoid some drying up of the slices in the preparation of the sample for analysis. Stanek and Vondrak[1] stated in an article on "Sampling for Sugar Factory Analysts" that during the subdivision of the slices, and during weighing, the quantity of water that evaporates is such as to make the sugar content of the slices at least 0·1 per cent. too high, the undeterminable losses, therefore, also being higher by this amount.

(2) In sampling the waste-waters and by-products of diffusion, and in preparing them for analysis, the evaporation of water plays no rôle, their sugar content being only small. Sampling, however, is not easy to carry out correctly, especially when the sugar content of the product is very varying. On principle, one should take the samples from the wastes as sent out of the factory ; thus in diffusion, not from the exhausted slices, but rather from the pressed pulp, the expressed water, and the diffuser run-off water. One can then accurately estimate the amount of the pressed pulp, or by-product containing the main amount of the sugar lost in the extraction, both when delivering fresh pulp and dried slices. It can therefore be assumed that the losses in the by-products of diffusion can be sufficiently accurately determined, provided there prevails the honest intention carefully to sample them.

(3) Sampling of the press scums is more difficult. As appears from numerous statements on the sweetening-off of scums, there are few factories in which this is uniformly done. Such tests, however, in which the presses are especially carefully sweetened-off should not be taken by way of example ; but one should give attention to such publications as reproduce actual working figures. There one meets with sugar content figures in the scums of single

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1 *Zeitsch. Zuckerind. Czechoslov.*, 1929-30, 62.

presses lying between 0·9 and 1·4 per cent.,[1] or 0·5 to 4·6 per cent.[2] in the same factory.

Proper samples are obtained only when they are taken from heaps by means of a probe, though here again arises the objection that the scums freshly discharged from the wagon drops down into the old layer, making any separation between old and new material to be hardly possible. In taking samples from the cakes of the presses, it is practically impossible to obtain correct average samples, and comparative experiments as well as experience teach that in most factories samples taken in the usual manner by the workmen at the presses show a sugar content much too low. It may rightly be assumed that in the usual sweetening-off method the true sugar content of the scums is almost always higher than is stated in the books on the basis of insufficient samples, and by 0·5 to 1·0 per cent.

B—Determination of Sugar Content.

It has often been thought that the sugar content of the by-products and waste products could be more correctly estimated by using the inversion method. Apart, however, from the fact that this method must give quite unreliable figures, since the conditions are quite different from those for which the method was worked out, its application here is wrong ; the dextro-rotatory substances present, which are unprecipitable by basic lead acetate, are also present in the beet, and must go into solution in the hot aqueous digestion method used for the analysis. One would, therefore, have also to examine the digestion liquid according to the inversion method, a useless complication ; while the error due to the unreliability of the method would then only be increased yet further.

(1) For the determination of the sugar content of the beets, and the by-products of juice extraction, one should therefore only use the usual method, taking care, however, that sufficient basic lead acetate be added, and that the mark content be correctly calculated.

(2) Regarding the sweetened-off carbonatation scums, recent experiments have shown that in many factories the usual method with the addition of acetic acid or ammonium nitrate is inadequate. I first drew attention to this by pointing out that the paste obtained by the mashing of the carbonatation scums of our factory with hot water contains regularly and every year twice as much sugar (while allowing for the weights concerned) as in the direct examination of the scum cakes. Later, this fact was confirmed by other investigators, especially by SPENGLER and BRENDEL,[3] and recently also by Russian investigators,[4] who found about 60 per cent. more sugar when mashing the scums.

(*II*) LOSSES, THE CAUSE ONLY OF WHICH CAN BE ASSIGNED.

To these losses belong : (1) Sugar losses arising from the effect of micro-organisms in the juice. (2) Polarization losses arising in juice clarification. (3) Sugar losses through the influence of heat. (4) Sugar losses in the filter-cloths, wash-water, etc.

(1) Only in exceptional cases can detectable amounts of sugar be decomposed by the activity of micro-organisms. Even in unfavourable cases, all such losses, often over-estimated, do not reach 0·01 per cent. of the beets. In working sound roots, one can without hesitation allow the juice in the battery to stand several hours, e.g., during the Sunday stoppage, without any harmful effect (acidification or inversion).

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1 *Centr. Zuckerind.*, 1929, 600. 2 *Deut. Zuckerind.*, 1929, 1290. 3 *I.S.J.*, 1929, 88. 4 *Deut. Zuckerind.*, 1929, 1214.

(2) In juice purification sugar losses cannot occur through the chemical action of the lime, only polarization losses can arise. Unpublished experiments carried out some years back by the author should be of interest, being hitherto the only factory results on this question. They extended over a whole week, in which 61,462 double centners (6146·2 metric tons) of roots with 14·66 per cent. polarization were worked. During this time, the raw diffusion juice, and the thin-juice was measured in accurately calibrated tanks provided with an over-flow; their weight was calculated, allowing for the temperature; and the polarization was determined in average samples.

Material.				*Polarization Sugar.*
61,462 dc. beets	with 14·60 per cent. pol.			901,054 kg.
80,415 dc. raw juice	with 11·05	,,		888,590 kg.
87,218 dc. thin-juice	with 10·07	,,		878,190 kg.
Hence loss in juice clarification			10,300 kg. ..	0·17 per cent. of roots.
,, ,, scums, 4797 dc. with 0·7 per cent. polarization			3,358 kg. ..	0·05 ,, ,,
Loss in liming and carbonatation........			6,942 kg. ..	0·12 ,, ,,

(3) Sugar is decomposed in hot alkaline solution in very small amount, though in determinable quantity only after a long time, and the more the higher the temperature. Sugar losses, therefore, in heating, evaporation and boiling are not to be avoided. On the basis of HERZFELD's experiments, I have tried to calculate the extent of this loss on the large scale, but all these figures are to be regarded as hardly trustworthy. All calculations made heretofore show sugar losses only to the extent of some hundredths of a per cent. on the roots.

(4) Sugar losses in the wash-waters and in the washing waters of the filter-cloth are so inconsiderable that they need not be considered in the calculation of the losses.

CONCLUSIONS.

(1) The total losses in the usual method of working in beet sugar manufacture amount to 1·2 to 1·5 per cent. of the roots when all determinations and calculations are carried out by methods recognized to be correct.

(2) A correct determination of the losses demands before everything a correct determination of the weight of the roots entering the factory. By faulty determinations of the weight, high or low apparent losses arise, namely (*a*) through the taring of the scale being never quite accurate, from ± 0·05 to ± 0·10 per cent. of the roots: (*b*) through an allowance for the nett weight not being considered, thus giving lower losses between 0·3 to 0·9 per cent. of the roots.

(3) When returning the beet wastes (tails) into process behind the beet scales, the amount of sugar thus introduced should be calculated.

(4) Due to inadequate sampling, too low figures are mostly found for the determined losses. With proper sampling, they amount to 0·4 to 0·6 per cent. of the roots.

(5) Undetermined losses, or losses undeterminable according to the usual methods, reach to 0·75 to 0·90 per cent. of the roots and are composed of: (*a*) Apparent losses due to incorrect tares of the beet scale, estimated at 0·05 to 0·10 per cent.; (*b*) increase of the polarization of the beet slices through drying up during the preparation of the sample, estimated at 0·05 to 0·10 per cent. (*c*) polarization losses arising from the action of the lime to the extent of about 0·1 per cent. of the roots; (*d*) a too low result for the sugar

content of the scums according to the usual method, to the extent of about 0·05 to 0·10 per cent.; (*e*) sugar losses in consequence of sugar decomposition and (*f*) mechanical sugar losses in the rinsing and washing waters, the extent of which under normal conditions is very small.

(6) Hence the cause of the undeterminable losses amounting to 0·75 to 0·90 per cent. of the roots is partly known, so that by estimation 0·30 to 0·40 per cent. can be explained. But, so far, one cannot account for the balance remaining.

Technical Notes from Usina Cucaù, Pernambuco.

By N. E. LAMONT.

Plantation refining.—A refinery built as an annexe to Usina Cucaù, was successfully inaugurated on the 16th September. Its capacity is 50 tons pilé per day (the same quality made by the sister refinery at Usina Ribeirao[1]) or 90 tons of "fine granulated." It was planned by the author, and the constructors of the machinery were George Fletcher & Co., of Derby, with the exception of the "Suchar" rotary filter, and the centrifugals which were furnished by Pott, Cassels & Williamson, Motherwell. This refinery is electrically driven throughout. At any future date the pilé produced, the quality of which gives great satisfaction to a very critical market, may be increased to 100 tons per day by the simple addition of another set of centrifugals.

"*Sumaphos*" *Clarification.*—Recent notices on the application of phosphoric acid in the defecation of cane juices point generally to an improvement in decantation, especially where there is a deficiency of this constituent in the cane soils. The writer has found by experience that not only is the decantation better in appearance, no matter what be the P_2O_5 content of the cane juice, but the revenue of sugar on cane rises, besides which the massecuites are freer in working, and the exhausted molasses are lower in purity. In light of recent experiences in our adjoining refinery, it is abundantly clear that washed sugars manufactured by the aid of a phosphoric acid clarifier are much superior in filtrability. They give much longer runs on the filters, which are much more easily washed, while the running costs of cloths are greatly reduced. Perhaps the most reliable phosphoric clarifier is the celebrated "Sumaphos" which is applied at the rate of 200 grms. per ton cane at the liming and sulphuring tanks, in the form of a slurry of 10° Bé. It has shown excellent results at Usina Cucaù, and elsewhere.

Washing massecuites with exhausted molasses.—Experiments were recently carried out by the author with a view to finding out what value, if any, there was attached to the suggested application of warm dilute exhausted molasses as a purge for the second massecuites. At this Usina two *jactos* are made from a normal juice purity of about 78·5° as follows: (1) Straight syrup massecuite, boiling on the "washings" from a previous 1st strike, and rendering a massecuite of about 74° purity and (2) 2nd or final massecuites, prepared from a footing of 1st grain, and boiled on the molasses of a previous 1st massecuite, rendering a massecuite of about 56° purity. After 36-48 hours in the crystallizers these 2nd massecuites are cured, and the molasses which is around about 26·5° purity goes to the distillery, while the sugar which is turned out without the addition of purging water,

[1] *I.S.J.*, 1930, 476.

goes to be mingled with the 1st massecuite from which mixture one product only of 99·8° polarization is produced, so-called "plantation white."

In the experiments under consideration, a solution of 30° Bé. of final molasses was prepared and warmed to 60° C. by means of a small steam coil and 2 litres per machine were applied by a spray nozzle just as the mother-liquor had passed out of the basket. Following closely on the pathways made by the mother-liquor on its exit, this warm dilute molasses passed very easily, and so completed the purging. Results showed that the purity of the resultant molasses was on the average 1° lower than when curing without this aid; the sugar was much easier to discharge; the second sugars were much cleaner; the final product was better in appearance and quicker in purging; and the actual time gained in curing each charge of second massecuite was reduced 20 per cent. The fall of purity of final molasses may be due to the warm molasses washing out the last remaining traces of mother-liquor, which ordinarily cling so tenaciously to the product. This practice of washing with warm diluted molasses is being continued.

Influence of pH on alcohol recovery.—There seems from the author's observations little doubt that the closer the *pH* of the initial wash is to that of the final fermented wash, the greater is the return of alcohol per cent. wash. In these particular experiments the vats were not washed out as customarily, but fresh wash was immediately run on top of the sour footings, and fermentation continued in the usual way, the following *pH* values being found: In the wash before entering the vat, and before fermentation commenced, 4·4; on completing the filling of the vat, 4·0; after fermentation, 3·7; and 12 hours after fermentation was stopped, 3·6. Ordinarily, the revenue of alcohol over wash was 5·5 per cent. (alcohol of 42·5° Cartier); but repeated experiments along the lines indicated above gave a revenue of 6·5 and over. This practice is therefore being continued as standard, once a week only the vats being thoroughly washed and disinfected. That the approximation of initial and final *pH* values is the explanation of the increase of 18 per cent. in the yield appears likely to the author, but anyway this is a point worthy of investigation by chemists interested in fermentation.

Carbon accelerant in fermentation.—For two seasons now the practice of adding exhausted vegetable carbon to the molasses wash for the purpose of accelerating the fermentation has been adopted at the distillery at Usina Cucaú, with great success. Exhausted carbon ("Suma-Carb," "Carboraffin," etc.) from the adjacent refinery is added to the vats at the rate of about 6 kg. of dry carbon per 22,000 litres of wash. No special yeast culture is employed. Wash of 8°Bé. is prepared from the exhausted molasses from the plantation white process, carrying a purity of about 26° and containing total sugars of about 52-55 per cent. It produces alcohol of 42·5° Cartier. Results obtained are as follows: (1) Washes which formerly took 36-40 hours to complete fermentation are now "ripe" in 26 hours, fewer vats being required. (2) Revenue of alcohol over wash has risen from an average of 4 years, of 4·41 per cent. to one of 5·35 per cent., or an increase of 22 per cent. (3) The still receives fresher "ripe" wash of a higher temperature as fermentation is rapid and stops very abruptly; and consequently stills are despatched at a greater rate than formerly, less fuel being required. It has been noted that the amount of carbon varies according to the season and cane or climatic conditions; but further study is required to arrive at an intelligent appreciation of this interesting phenomenon.

Factory Results in Java during the Last Seven Years.

By R. J. PRINSEN GEERLIGS.

In the annual report on the Java sugar industry, published in the June issue of this Journal, the table of Factory Results hitherto regularly given was omitted for lack of authorization to reproduce. The Board of the Sugar Experiment Stations having now revised its ruling in the matter, we are enabled to give below the annual synopsis of these factory data. with comparative figures for the six previous years.

JAVA FACTORY RESULTS DURING THE LAST DECADE.

	1923	1924	1925	1926	1927	1928	1929
CANE—							
Sucrose	13·06	13·10	13·90	12·40	12·90	13·50	13·89
Fibre	13·14	12·90	12·80	12·80	12·70	12·70	12·70
BAGASSE—							
Sucrose	3·75	3·60	3·30	3·00	2·90	2·90	3·00
Moisture	46·49	46·30	45·50	48·70	45·50	45·20	43·80
SUCROSE EXTRACTED BY MILLS	92·20	92·80	93·90	94·35	94·73	94·07	94·60
SUCROSE IN FILTER-PRESS CAKES	3·20	4·10	3·80	3·50	3·40	3·70	3·40
SUCROSE IN JUICE PER 100 CANE	12·04	12·17	13·08	11·70	12·22	12·70	13·14
PURITY OF RAW JUICE	84·60	83·70	84·00	80·90	83·30	84·30	84·10
PURITY OF FINAL MOLASSES	31·30	30·50	30·50	30·00	29·30	30·10	31·00
CALCULATED AVAILABLE SUGAR	11·51	11·51	12·45	10·87	11·59	12·45	12·81
SUGAR EXTRACTED PER 100 CANE	11·43	11·44	12·38	10·85	11·62	12·16	12·42
SUCROSE TURNED OUT PER 100 OF :—							
Cane	10·92	10·92	11·82	10·33	10·45	11·59	11·84
Sucrose in cane	83·10	83·35	85·03	83·30	85·50	85·80	85·30
Sucrose in juice	90·71	89·80	90·40	88·30	90·50	90·70	90·10
SUCROSE LOST PER 100 OF :—							
Cane	2·14	2·18	2·08	2·07	1·77	1·91	2·05
Sucrose in cane	16·90	16·65	14·97	16·70	14·50	14·20	14·70
Sucrose in juice	9·29	10·20	9·60	11·60	9·50	9·30	9·90
LOST IN BAGASSE PER 100 OF :—							
Cane	1·02	0·93	0·85	0·71	0·68	0·73	0·75
Sucrose in cane	7·77	7·10	6·10	5·73	5·60	5·40	5·40
LOST IN FILTER-PRESS CAKE PER 100 OF :							
Cane	0·09	0·07	0·07	0·06	0·07	0·08	0·08
Sucrose in cane	0·69	0·50	0·50	0·48	0·56	0 57	0·57
Sucrose in juice	0·72	0·60	0·50	0·50	0·60	0·60	0·60
LOST IN MOLASSES PER 100 OF :—							
Cane	0·80	0·90	0·92	1·04	0·79	0·84	0·93
Sucrose in cane	6·09	6·90	6·60	8·39	6·46	6·24	6·61
Sucrose in juice	6·65	7·50	7·10	8·90	6·90	6·60	7·10
UNACCOUNTABLE LOSSES PER 100 OF :—							
Cane	0·23	0·28	0·24	0·26	0·23	0·25	0·29
Sucrose in cane	2·35	2·15	1·77	2·10	1·87	1·89	2·09
Sucrose in juice	1·92	2·10	2·00	2·20	2·00	2·00	2·20

THE OUTLOOK FOR PHILIPPINE SUGARS.—There are now 41 sugar centrals at work in the Philippines, besides two not operating, with a daily cane capacity of 50,810 tons. According to a Department of Overseas Trade Report, much uneasiness exists in Manila over the frequent efforts made in Washington to increase the duty on Philippine sugar entering the United States so as to protect American beet sugar producers. If brought to the level of the duty on Cuban and other sugars it is believed that Philippine sugar could not compete in view of the relatively high costs of production. There have even been suggestions of voluntary cessation of expansion in production so as not to aggravate the position in the United States, but nothing has been decided.

The Value of Superheated Steam.

Modern Methods for the Sugar Industries

In the operation of almost any industrial establishment and, particularly, sugar refineries where a large amount of steam is required for heating and boiling, it is essential for the most efficient results to use superheated steam. The advantages are of two kinds, the first relating to medium or high superheating to increase the efficiency of steam engines or turbines, often corresponding to 10 per cent. saving in the coal bill, as compared with saturated steam, and, secondly, moderate superheating for avoiding condensation in long pipe lines, which causes much more loss than is generally imagined.

Undoubtedly one of the most striking advances in the practice of steam generation during the past year or two is the increased superheated steam temperatures now being used, which range from 750° to 900°F., whereas only a year or two ago 725-750°F. was regarded as the safe limit with ordinary low carbon steel. This applies not only to the latest super-power stations, but also to the industrial plants, in which field the latest methods are now being more widely employed, such as high pressure water-tube boilers, improved mechanically stoking pulverized fuel firing, air heating, pass-out steam turbines or engines for low pressure process steam, and superheating at 750°F. or over. Some recent examples of outstanding interest in the latter connexion in great Britain are the boiler plants of Synthetic Ammonia and Nitrates Ltd., Billingham-on-Tees, the Bolsover Colliery Co., Ltd., the Agwi Petroleum Corporation, Southampton, and Taylor Bros. Ltd., Trafford Park, Manchester, and in Australia the new boiler plant of Australian Iron and Steel Ltd., Port Kembla, New South Wales, for all of which the Superheater Co. Ltd. of London have supplied the superheaters, as well as to many others in different parts of the world.

The " M.L.S." design of superheater is equally applicable to "Lancashire" and other industrial boilers, as well as marine and locomotive boilers and general chemical plant, such as low temperature carbonization of coal and oil cracking. The chief feature is that the multiple-pass loop superheater elements are made of a number of tube lengths connected together by a special machine forging process, no screwed or welded joints being used. The saturated steam enters a header consisting of a large diameter steel pipe, and passes through any desired number of long loop elements, fixed parallel to one another to the superheated steam headers. This single-pass arrangement has the advantage that it ensures uniform steam distribution and thus avoids the risk of local overheating, while by the use of a clamped metal " ball " type of joint between the elements and the headers, expanded joints are avoided and hand-hole fittings eliminated. For " Lancashire " boilers, and in nearly all cases for water-tube boilers, when the design of the latter allows, the headers are outside the setting, thus allowing of direct access for inspection and adjustment, while such modern methods of design and construction ensure that superheaters give maximum efficiency and a high degree of reliability in service.

BAGASSE UTILIZATION.—Demonstrations are being made in London of the Freeman process for the utilization of bagasse and similar vegetable matter by its dry distillation in a special apparatus for the recovery of methyl alcohol, acetic acid, acetone, furfural, and other products. A special retort, the design of which is included in the Freeman patents, is provided with means for consuming the gas produced in the distillation. It is suggested by Mr. Freeman and his colleagues that the residual carbon from the retorts should be consumed in the sugar factory boiler-house or in plantation locomotives.

Correspondence.

MAURITIUS AND SUGAR MACHINERY.

TO THE EDITOR OF "THE INTERNATIONAL SUGAR JOURNAL."

SIR,—At page 397 of your August issue, I read the following editorial in your *Notes and Comments*, under the heading *Empire Free Trade and Sugar* :—

"If we are to take on preferential terms the sugar of the Empire overseas, there must be corresponding willingness for the sugar producer to continue buying his sugar machinery and factory equipment and supplies from the country that consumes the sugar. We mention this point because we notice a tendency (doubtless a legacy of the war days, when communications were slow and orders difficult to complete) for the Dominions and even the colonies to draw more on local sources for their equipment needs and less on the engineering shops of the old country. *Even Mauritius*, as is shown in SIR FRANCIS WATTS' recent report, *is developing engineering shops*, capable of making much of the machinery required for the factories. Such large items as vacuum pans, triples, crystallizers, juice heaters, elevators, pumps, etc., are being supplied to Mauritius sugar factories from local engineering shops. And this practice *unless challenged* will tend to increase, to the detriment of the old-established engineering firms in England and Scotland. These last should assuredly not be overlooked if and when the time comes to place the Empire sugar industry on a firm basis ; if the United Kingdom assures the market for the sugar, *it should be guaranteed the main share of making the plant and equipment to produce that sugar*."

The italics are mine. Allow me, Sir, to deprecate the suggestion with which the above-reproduced passage is unquestionably pregnant, that Mauritius is not playing the game in this matter.

In the first place, it will appear to all fair-minded people to be a highly questionable proposition of inter-Imperial ethics, that this, or any other Colony, should be precluded from developing a local industry, simply and solely because such industry happens to exist in the Home Country. On this assumption, Mauritius and the West Indies, for instance, might find fault with the Home Country for keeping up, and in every way fostering, its beet sugar industry—which would not only be impertinent, but altogether absurd. So long as we do not purchase from alien countries those things which we can procure from the U.K or the Empire, it will, I think, be agreed that the integrity of our trade loyalty is safeguarded.

So much for the question of principle. Now, coming down to matters of fact, it is not quite accurate to say that we "are developing engineering shops, capable of making much of the machinery required for the factories." Our local engineering shops are old-established concerns, whose scope has *not* been enlarged of recent years, as your article would suggest, and as the late Sir FRANCIS WATTS did *not* state, or even hint, in the Report to which you allude. Sir FRANCIS WATTS, whose authentic patriotism no one would presume to question, any more than his professional eminence or his acuity of judgment, refers to the efficiency of our local workshops, in words of unqualified approval, as enabling us to "maintain the sugar machinery of the Colony in good running order," not as constituting a menace to Home suppliers of major machinery.

Surely, no "guarantee" is needed that the "main share" of our orders for such major appliances will continue to be placed in the U.K. Such has always been the practice, and there exists no contrary tendency requiring to be "challenged." It is quite true that, during the past few years, orders for manufacturing plant have decreased heavily ; but the decrease has been due to the disastrous decline in sugar values and the consequent progressive depletion of our sterling balances at Home. How could people be expected to order

costly machinery, when they have no money available wherewith to pay for the same ?

The subjoined table will be found instructive, as illustrating the essential correlation between yearly proceeds of our sugar production and value of machinery imported in subsequent years, for agricultural purposes and sugar fabrication. In the calendar year 1921, following upon the halcyon period 1920-21, the value of such imports exceeded £446,000. Succeeding years show as follows (round figures in £1000) :—

Crop Year.		F.O.B. Value of Crop.		Calendar Year.		Value of Machinery Imported.
1921-22	..	£3,692,000	......	1922	..	£240,000
1922-23	..	£4,460,000	......	1923	..	£119,000
1923-24	..	£5,275,000	......	1924	..	£233,000
1924-25	..	£4,175,000	......	1925	..	£144,000
1925-26	..	£3,236,000	......	1926	..	£112,000
1926-27	..	£3,169,000	......	1927	..	£113,000
1927-28	..	£3,485,000	......	1928	..	£84,000
1928-29	..	£3,223,000	......	1929	..	£64,000

Better prices for sugar, especially if coupled with assistance to Mauritius factory owners out of the Colonial Development Fund for renewals and improvements of machinery, would at once determine a marked recrudescence of orders for factory plant from the U.K. It stands to reason that more adequate Preference would also be attended with instant reaction in the same direction.

Yours faithfully,

P. H. GALEA,

Secretary, Mauritius Chamber of Agriculture.

*** We gladly publish this letter from Mr. GALEA. As regards the question of fact, we regret if we read more into the details of Sir F. WATTS' Report than was intended. But as he did not give any chronological data with regard to all the machinery enumerated as having been turned out in Mauritius, it was not unnatural if we concluded that it had been produced of late years rather than during, say, the last 50.

On the question of principle, the suggestion we made was on a par with that which was later put to the Imperial Conference in London by several Dominions delegates, that the U.K. should take the excess food production of the Dominions and that the latter by way of reciprocity would consider taking U.K. manufactured goods. Incidentally, the analogy of the Home beet industry seems to miss our point, since the latter industry does not export its sugar overseas, nor does it so cover home requirements as to shut out Mauritius sugars.—ED. *I.S.J.*

NEW CANE CULTIVATOR.—The Brown-Gomez unit consists of two 15 H.P. engines with pulling and hoisting devices, and a cultivator of a very simple type consisting only of a steel frame shaped like an inverted U, mounted on two wheels, with a small balancing frame where the ploughs are attached. The main frame when in operation passes between two rows of cane, and the ploughs do the cultivating. The engines are placed at each end of the field, and the operation consists of pulling the cultivator by one of the engines while a dead cable from the other engine is being laid in the next row. At the end of the trip, the cultivator is lifted by means of the lifting device and let down in the next row. Then the engine on the other side of the field pulls the cultivator back and operation is repeated until the field is finished. A hectare (2·47 acres) field of cane can be easily cultivated in three hours, and the gasoline consumption is about three U.S. gallons per hectare. The number of men required to handle the work is 4, that is, 1 on each engine, 1 on the plough and 1 as a general helper. Three to four hectares can be easily cultivated in a day. The amount of work done by this machine in a day would require from 30-40 carabaos and about 20-25 men to do the work.

1 *Sugar News*, 1930, 11, No. 6, 312-314.

Publications Received.

Betriebskontrolle der Zuckerfabrikation. II Teil: Chemische Technische Rechnungen. Third enlarged and improved Edition. Dr. Oskar Wohryzek. (Schallehn & Wollbrück, Madgeburg). 1930.

A previous edition of this "Hilfsmittel" was noticed at the time of its publication.[1] It consists of worked out calculations for use by beet factory and refinery chemists for control purposes, these being divided up into nine parts covering the several stages of manufacture and refining. One is shown how to obtain data on quantities as: raw juice in process, draw-off, losses, wet and dry slices; lime CO_2 sulphur, and soda; first and after-products, mixed massecuites, green syrup and molasses to be expected under varying conditions. There is a good section on yield calculations on different bases, and several methods are shown for making out the inventory of the factory. Certain errors and obscure statements printed in the previous edition have been corrected and made clear, and now there is little to say on the point of accuracy, excepting that it is noticeable in dealing with the calculation of the quantity of dry slices from wet slices that the author does not take into consideration the dry substance in the water expressed. Though some of the calculations are elementary in character, most are well selected, and will, we believe, be found distinctly useful.

The Chemical Investigation of Plants. By Dr. L. Rosenthaler; translated by Dr. Sudhamoy Ghosh. (G. Bell & Sons, Ltd., London). 1930. Price: 12s. 6d.

This is a translation of a German book which has had a good reception among research workers in the domain of plant chemistry, having already gone through several editions. In it the reader is provided with the fundamental principles involved in the systematic chemical investigation of a plant, and with the general methods followed for the isolation and purification of the various classes of chemical compounds met with in the vegetable kingdom. One here finds special methods for the detection and determination in plants of sugars, vegetable acids, proteins, colouring substances, waxes, etc. It is a book which should prove a useful guide to a difficult subject, not only for the agricultural chemist, but also for research workers, engaged in the study of plant products from different points of view.

The Spirit of Chemistry. Alex. Findlay, M.A., D.Sc., Ph.D.; Professor of Chemistry, University of Aberdeen. With Portraits and Illustrations. (Longmans, Green & Co., London). 1930. Price: 10s. 6d.

Prof. FINDLAY'S previous volume "Chemistry in the Service of Man" met with a warm reception as an introduction to chemical science for the general reader; and encouraged by the way in which it was received he has now issued this book, in which a similar method of treatment of the subject is involved. It is published more particularly for those students who in the Universities of Great Britain and in the Colleges of the United States pursue in increasingly large numbers a course in chemistry as an element of general culture rather than as a part of their professional or technical training. Prof. FINDLAY certainly uses an attractive method of presenting his material. His is no dry textbook, but a series of essays in 29 well illustrated chapters (many of them complete in themselves), which impart much knowledge in an interesting manner. We strongly recommend the book to the general reader.

Memorandum on Dust Explosions. Factory Department; Home Office; Form 829. (H.M. Stationery Office), 1930. Price: 6d.

Sugar refiners and millers will find this short publication of the Home Office worth a careful reading. It deals with the nature of dust explosions, and with the causes of ignition of dust clouds, including the interesting theory of hydrostatic charges, which was exposed in these columns a few years ago.[2] It outlines special precautions to be observed where there is risk of dust explosion.

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[1] *I.S.J.*, 1920, 583. [2] *I.S.J.*, 1922, 373; 1923, 363, 412.

Brevities.

SOUTH AFRICAN PRODUCTION. According to the Standard Bank of South Africa, the total raw sugar production for the present season is estimated to reach 380,000 short tons. The amount of the exports at mid October was about 87,000 short tons, principally to the United Kingdom; this represents approximately half the export quota for the 1930-31 season.

THE D.O.T. AND JAMAICA.—The Department of Overseas Trade announces that a Branch Office of H.M. Trade Commissioner's Office in the British West Indies will be opened in Jamaica early in the new year, under the charge of Mr. Massie-Blomfield, who since 1923 has served as Intelligence Officer in the Department of Overseas Trade, and prior to that was in the Egyptian Civil Service.

SUGAR BEET IN THE U.K.—The United Kingdom Minister of Agriculture, Dr. Addison, lately received a deputation from the Beet Sugar Factories Committee of Great Britain to discuss the present position of the sugar beet industry in this country. The interview was private. Amongst those forming the deputation were: Sir James Martin, Mr. J. B. Talbot-Crosbie, Mr. J. N. Mowbray, Mr. J. P. van Rossum, and Mr. Alfred Wood.

JAVA'S ATTITUDE TO THE SUGAR CRISIS.—A correspondent of Willett & Gray wrote that early next year the question of the 1932 plantings in Java must be settled. Indications are that a reduction in the area may be decided on, and the more expensively rented plots be left out of the cane acreage. Java is not going to produce sugar below cost if she can help it, and the mill managers have received instructions to cut down expenses, so as to reduce the cost of production still further.

JAMAICA REFINERY.—It is reported that The United Fruit Co., New York, has secured a concession from the Governmental Sugar Board at Kingston, Jamaica, for the construction and operation of a bonechar refining plant. Work on the project is expected to begin shortly. The plant will be equipped for an initial capacity of about 75 tons of finished material per day and will cost over $500,000, including machinery. The company's engineering department will be in charge of the project.

IMPERIAL PREFERENCE ON SUGAR ASSURED FOR THREE YEARS.—The United Kingdom Government declared at the Imperial Conference that "existing preferential margins would not be reduced for three years subject to the rights of Parliament to fix the Budget." This is taken to imply that, subject to the right of Parliament to vary the sugar duties, the present Government did not propose to alter the existing sugar preferences for at least three years, and to that extent the Empire sugar producers seem assured of continuity of policy.

SCALE PREVENTION.—An electrical process for the prevention of scale formation in boilers is now under trial in different parts of the United Kingdom, having aroused some interest in view of its possibilities. It consists in passing a current, which, depending on conditions, varies between 1·3 and 4 amps. whilst the pressure is of the order of millivolts. The idea is to bring the metal to the same polarity as the water and its impurities, thus causing repulsion between the two. It is claimed that in this process scale formation should be entirely eliminated, the inorganic matter thrown out of solution being deposited in the form of a sludge. Further, that the process is a very economical one, the apparatus costing relatively little to install, and practically nothing in the way of supervision and replacement for its working. It is proposed later to investigate its possibilities in regard to evaporators, pans, heaters, etc.

HOWARD CANE HARVESTER.—A report states that this machine has undergone successful trials near Bundaberg under difficult conditions, and a company has been formed to exploit the invention in Australia and elsewhere. Working in a 20 tons per acre crop, the machine travels about 64 chains per hour, which with cane planted in rows 4 ft. 8 in. apart, is equal to an output of 9 tons per hour. Its total running costs (1 gall. of petrol per hour, one man, lubrication, etc.) amount to 9s., or, on an output of 9 tons per hour, 1s. per ton.[1] It is very simple in design and can be manufactured and marketed at a price well within the reach of practically every cane grower, and still provide a satisfactory margin of profit to the Company.

1 Data from the Prospectus of Howard Cane Harvesters, Ltd.

Brevities.

Hérisson Crystallizer.—By means of this water-cooling type of crystallizer, the massecuite can be cooled down in 8 hours for 1st and 12-14 hours for low-grade massecuites. This apparatus has shown an appreciable gain in recovery from massecuite, in some cases up to 10 per cent. When this is taken into consideration, it means a saving in steam through cutting down the quantity of low-grade liquors being handled.

Lectures on Sugar.—Attention is called to the courses of lectures on the Sugar Trade about to be held at the City of London College, commencing on January 9th. There are 15 lectures on the Scientific Study of Sugar by S. J. Duly, M.A.; 7 on the Marketing of Sugar by W. O'Toole, F.C.I.S., Secretary to the Sugar Association of London, and the United Terminal Sugar Market Association; and 8 on the Economic Geography and Statistics of Sugar by Dr. C. J. Robertson, M.A., B.Sc.

Werkspoor Marine Oil Engines.—A new motor liner, the Columbia, which the Royal Netherlands Steamship Co. have put into service between Amsterdam and the West Indies, has attracted some attention in the general press on account of her modern design and equipment. Of some 9000 tons gross weight, she is fitted with two sets of Werkspoor 8-cylinder oil engines, developing 8000 h.p. and driving the ship at a service speed of 15 knots. The passenger accommodation contains many luxury features usually only found in vessels of much bigger tonnage.

Suchar Refining.[1]—A Suchar refinery is remarkable for its compactness and the relatively small size of buildings required. Hence the first cost of such a refinery is decidedly low, in relation to its productive capacity. Owing to its compactness the amount of labour required for operating the refinery is surprisingly small. Supervision can be taken care of by the managing staff of the raw mill, without materially adding thereto. The various refinery operations require very little time, with the result that only a short period is needed to convert raws into highest quality refined sugar. These factors, combined with low fuel and water consumption, high recoveries, savings due to elimination of the need for raw sugar bags and other attendant economies, make refining at the central by the Suchar process a very profitable undertaking.

Plantation Refining.[2]—Sugar refineries attached to raw sugar factories represent a very low capital investment as compared with independent refining plants. Economy of operation favours the arrangement. A reliable supply of refined sugar has a tendency to increase local consumption generally, and particularly for industrial purposes. Anticipating this movement, H.I.W. engineers have designed a refinery most easily and economically attached to any existing factory. Among those already in successful operation is that of the Victorias Milling Company, attached in 1928 to the factory built and installed by the H.I.W. Co. in 1921. The only equipment required in addition to that already in use was the white sugar boiling pan, centrifugals, and the bonechar plant. Additional buildings are negligible. Savings in fuel, superintendence, labour, laboratory, and so on, are obvious.

Training Chemists.—Dealing with the training of sugar chemists, Mr. S. B. Watkins, Department of Chemistry, Queensland Technical College, remarked in the course of a paper: "Education is a prime and essential factor in giving the student the broad outlook so necessary in the sugar industry. There is little difficulty in training a person to carry out an analysis of sugar, yet such a person is far behind one who has had the basic principles of such methods outlined to him. The former will stand still or progress at a slow rate, whereas the other, possessing a broadened outlook and enhanced intelligence, will make rapid progress in his work. The aim of sugar education should not be merely to train a person along a definite line to perform a definite operation associated with sugar work, but rather to inculcate into the person undergoing the training the broad basic principles upon a sound foundation, and to develop the capacity for thought as well as action.

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[1] From a recent advertisement.
[2] From a recent advertisement of the Honolulu Iron Works Co.

Review of Current Technical Literature.[1]

IMPROVEMENTS IN MILLING EQUIPMENT. **Rene Weil.** *Proceedings of the Third Annual Conference of the Association of Sugar Technologists of Cuba.*

During the past few years the capacity of mills in Cuba has increased considerably, so that the rate of 200,000 arrobas (2260 long tons) in 24 hours formerly considered a maximum for a large tandem has to-day increased to 500,000 arrobas (5650 long tons) with an appreciable increase in the extraction. These results have been due to improvements in constructional details of the milling equipment. Amongst modifications in mills one may cite the increase in rotating speeds, increases in the size of roll groovings, adoption of McNeil type of tooth profiles, generalization of Messchaert deep juice-grooves, application of compression rolls to equalize the blanket thickness, increase of pressures on roll shafts and notable improvements in imbibition. These improvements have come hand in hand with mechanical and lubricating refinements, without which continuous and uniform crop operation would not be possible, if one considers the enormous pressures and accelerated speeds now prevalent. Shut-downs from choked mills, hot journals and other accidents and incidents springing from insufficiently perfected mechanical design would doubtless limit the working capacity of Cuban milling equipment. Modern devices of present-day milling equipment are now summarily described: *Steel Housings.*—The construction of steel housings, doing away with the need of large transverse bolts, allows a closer approximation of lower rolls, thus reducing the width of the turn-plate to a minimum. A rocking turn-plate is the most resistant, but, at the same time it must be sufficiently large to encompass the radius of oscillation so that after the abrasion of the wearing sides has set in the inclination of the turn-plate be slight and normal operating conditions of the mill suffer no variation. To attain these desiderata it is indispensable to build cast steel housings in a single block, reaching to the foundation, thus allowing the greatest possible radius of gyration to the turnbeam.

Hydraulic Pressure.—Mill and crusher hydraulic caps are designed for the double purpose of reducing leather wear to a minimun and, simultaneously, allow the quick and easy replacement of leathers. Hydraulic pressure rams move within well-fitting bronze lined cylinders of considerable length, thus lessening the tendency to wedge tight under the strain of the oblique movement of the rolls and the irregularity of the reactions of the rolls amongst themselves, while reducing wear to a minimum. This action is completed through methodical lubrication fed under the leathers and conveyed by grooves toward parts where friction is greatest. It is evident that the lubricating action of the hydraulic pressure oil cannot be relied upon at all, since this oil is completely absorbed by the leather; betwixt leathers and cylinders no lubrication exists, thus provoking rapid deterioration of the leathers. On the other hand the leathers employed are of the best quality, appropriate for the task required of them. Leathers in mills of modern construction have a much greater useful life than formerly and there are instances where leathers have worked during four consecutive crops without replacement. Hydraulic caps, in turn, are built to allow easy replacement of leathers, with minimum lost time. To do so it is necessary merely to unscrew a light-weight plug, change leathers and screw the plug in again, an operation requiring a few minutes. The thread is of a special cut which prevents adherence under the action of the heavy pressures involved, so that the loosening operation is effected without the need of special wrenches. Therefore, there are no heavy pieces to dismount nor bolts to take out, thus economizing time and work to effect changes when necessary.

Hot pressing of shells.—Hot pressing of shells on shafts, along the entire length of the roll, is an extraordinary advantage. This system precludes the use of pins, wedges, bands and flanges, etc., necessary with other processes to avoid slippage or striating of shells on shaft. Failure of such has depended solely on a deficient technique of the system in question, since the record available covers hundreds of rolls built according to this technique of hot fitting, without a single protest by mill operators and without one case of slippage or broken shells. Shop work must be executed with extreme care and this can be obtained only with special high pressure devices, appropriate tools and able and expert personnel trained to this type of work.

Any difference of a few hundredths of a millimeter may completely alter the elements of resistance of the parts, or the solidity of the fit. Material must be first class. Shafts should be of semi-hard Siemens-Martin steel, and the shells of special cast-iron, the metal being, above all, very homogenous and of uniform grain. With the hot fit system nothing acts to modify the efficiency of the adjustment previously fixed. The surfaces of contact, neither previously lubricated, nor subsequently glazed, as a result of the operation, have a very high coefficient of adherence. Also, the slight roughness of the resulting from the machining operations interlock, still increasing the adherence to a much higher extent, so high in fact that it is practically impossible using a press to extract from its shaft a mill shell correctly mounted by the hot fit method. It is necessary in fact to break the shell.

STEAM REQUIREMENTS OF VACUUM PANS. **A. L. Webre.** *Proceedings of the Third Annual Conference of the Association of Sugar Technologists of Cuba.*

In this article the problem is considered how the steam consumption by the pans can best be equalized for the various strikes. A case is taken for consideration of a 400,000 arroba (4520 long ton) house, having a commercial yield of 12·82 with *meladura* or evaporator syrup at 86° purity, working on the three boiling system in which the *C*-sugar is used for seed in the *A* and *B* strikes, pan conditions being :—

Strike.	Brix.	Strike Purity.	Molasses Purity.	Sugar Polarization.
A	93·0	80·0	62·0	96·0
B	94·0	70·0	48·0	96·0
C	95·0	58·0	30·0	87·0

Steam consumption of the *A* pans is 42,200 ; of the *B*, 15,700 ; and of the *C*, 13,700 ; a total of 71,600 lbs. per hour. It is assumed that there are five 12 ft. pans, all of the calandria type, the capacities being 1264 cub. ft. for the grain strike, 1235 for the *A*, 1216 for the *B*, and 1264 for the *C*. Performance curves are plotted for the 12 ft. pans in question, these showing the varying rates of evaporation as well as the steam consumption for each strike. Having this information, a time-table is drawn up having as its object the minimum amount of steam variation throughout. These pan curves show in the first place the great difference in the steam consumption between the beginning and the end of the strike ; and in the second place that the different strikes have very different steam consumptions, depending apparently on the purities and viscosities of the massecuites being elaborated. Thus for grain strikes, the peak of steam consumption is 43,500 lbs. per hour ; and the valley, 9500 ; for *A* strikes, peak 35,000, valley 16,000 ; for *B* strikes, peak 23,000, valley 9000 ; and for *C* strikes, peak 18,000 ; and valley only 800. In each case, the peaks are attained in every case shortly after the beginning, and the valleys at the very end.

This schedule-timing for the starting up and finishing of the pans was planned by the author as carefully as could be, yet immense variations from the average of 71,600 lbs. per hour were experienced, the maximum being 93,000 and the minimum 32,000, that is a variation corresponding roughly to about 2000 B.H.P. If the worst possible conditions were to obtain when the five pans reached their peak at the same time, this would mean 154,500 lbs. per hour, corresponding to about 5000 B.H.P. In making up the schedule, one must first consider the heavy load made up of grain strike and *A* strikes, 1 of the former, and 17 of the latter. No. 1 and No. 2 pans make *A* strikes only, and each pan is scheduled to make 9 strikes per 24 hours, or 1 every 2 hours and 40 mins. When grain is being made in No. 4 or No. 5 pan, one of the *A* pans is down for one cycle for the available *meladura* is needed to make grain, so that there is no work for this *A* pan at this time. This also enables one to take care of the heavy graining load with the steam normally available for the *A* strike. Thus every hour and 20 mins. there is started either an *A* strike or a grain strike. The *B* strikes, of which there are about six, should have steam turned on at the precise moment when steam is shut off one of the *A* pans. This compensates a peak with a valley, and thus smoothes out the curve. In the same way the *C* strikes, of which there are four, should also start at the precise moment when steam is shut off an

A pan. It is unnecessary to emphasize that *B* and *C* pans must not start simultaneously, in fact no two pans must ever start at the same time. This schedule assumes syrup taken from the evaporators at 64°Brix. One must remember that it takes four times as much steam to evaporate *meladura* in the pans as it does in the quads. If this density drops to 50°, the differences in the steam consumption of the pans will be 32,000 lbs. per hour, or 50 per cent., or nearly 1000 B.H.P. Boil-back molasses must not be diluted for the same reason, and any dilution below 60°Brix involves additional steam expense. Probably the best investment any factory can make, and it is not a large one, is to put a good recording steam flow-meter, which will indicate how much steam is being used.

COMPARISON OF THE MILL WORK OF ONE ESTATE WITH THAT OF ANOTHER. **J. R. Mayo, Jr.** *Proceedings of the Third Annual Conference of the Association of Sugar Technologists of Cuba.*

It is known that the milling coefficient of tandems is not a sufficiently accurate base to establish comparisons. The sucrose extraction, expressed in per cent. sucrose in cane, in addition to leaving one ignorant with respect to the fibre in the cane, which is such a decisive factor in the possible extraction, is a qualitative indication of the work of the tandem, without including quantitative data of the grinding. Lacking a better basis for the more exact comparison of the work of one tandem with respect to that of another, the author proposes to study the following method, which consists in the modification of the milling coefficient based on the ratio of the extraction obtained to the theoretical extraction obtainable : Let A = arrobas of cane ground in complete days ; D = diameter of rolls in inches ; L = length of rolls in feet; and N = number of rolls; then, the milling coefficient will be : $\frac{A}{DLN}$. Extraction obtained being e, and theoretical extraction E, then the modified milling coefficient is : $\frac{A\,e}{DLNE}$. The theoretical extraction E may be taken in each case, from a table such as that shown on page 237 of NOEL DEERR's "Cane Sugar," including therein as many intermediate values as desired and assuming an amount of fibre in final bagasse sufficiently high to allow the proposed formula to show a result thus far never obtained by any tandem. Although purely empirical, the author believes it will be useful in lieu of anything better. NOEL DEERR's table, indicates theoretical extraction on the basis of the fibre in the cane, the fibre in the bagasse and the imbibition water used, assuming perfect distribution of the latter. It might be objected that the proposed formula is more a means for knowing the efficiency of the maceration, rather than the efficiency of the grinding itself ; but all are aware that after the first two or three mills the bulk of the work done depends precisely on the efficiency of maceration.

APPLICATION OF ACTIVATED CARBONS TO SUGAR REFINING. **J. P. Foster.** *Reports of the Association of Hawaiian Sugar Technologists for* 1930.

In order to arrive at an understanding of the limitations as well as the capabilities of decolorizing carbons, it will be necessary to bear in mind some fundamental statements (due to CHANEY, RAY and ST. JOHN) : The adsorptive power of carbons for particles bearing an electrical charge is diminished if the carbon bears a charge of like sign and increased if the carbon is oppositely charged. (2) An active carbon may be neutral, or may readily become positively or negatively charged by the adsorption of hydrogen or hydroxyl ions from solution. (3) The carbon may be caused to assume the desired electrical charge prior to its introduction into any given solution or liquid. (4) The fact that a given carbon is electrically charged does not influence its adsorptive capacity when it happens to be re-acting toward neutral particles, but becomes of decided moment when it is employed to adsorb particles which do carry an electrical charge. Add to these statements the fact that the natural colouring matters found in almost all industries including sugar are usually basic, we understand why an acid carbon is usually used for sugar liquors. When the

decolorizing power of the carbon falls off, it is supposed that its capillary system is filled, and that it should then be put through some process of revivification. But the probabilities are that the carbon has reached a state of electrical equilibrium long before the pores are clogged, and that if the electrical potential were restored the carbon would be given a new lease of life, much more service being obtained from it before revivification were actually necessary. Owaga found that a considerable shift of the iso-electric point in a carbon may be effected by varying degrees of heat during activation.

It was once thought necessary to work with an acid liquor, but one now knows that a *pH* of 7·0 or higher can be used, so long as a sufficient potential is maintained between the carbon and the ionized colloids present. The problem of working with an acid carbon does not seem to be serious if due consideration is given to the character of the acid employed. There are several excellent carbons activated by phosphoric acid, the acid reaction of which is due to this acid; but the invertive action of phosphoric acid is only 1/18 that of hydrochloric acid. Nor is there any reason why the temperature should exceed 40°C. Opponents of the carbon refining process have entirely overlooked the fact that inversion losses in the bonechar house are usually around 1 per cent. Another argument is that "elimination" by carbon is less than by bonechar. Pound for pound the elimination of carbon may be better than by char; but because the quantity of char required is from 75 to 200 times greater the elimination in the char-house is proportionately greater. This is true as far as it goes but a most important factor is overlooked. Due to the long continued and heavy washing to which the char is subjected, the water-reversible colloids are completely washed out of the char, and only the water-irreversible colloids are retained throughout the washing process. Inasmuch as the water-irreversible colloids, which constitute up to 50 per cent. of the total, are the most objectionable, and are all returned to process by way of the sweet-waters, it would seem that the supposed superior elimination by char is not as important as the char advocates would have us believe. Lastly the author argues for research work to be undertaken in Hawaii for the purpose of developing a carbon process best adapted to the needs of the sugar industry there.

Decomposition of the Reducing Sugars in Alkaline Medium during Sugar Manufacture. **K. Douwes Dekker.** *Paper read before the Third Congress of the International Society of Sugar Cane Technologists, held in Java,* 1929 (here abridged).

Decomposition of the reducing sugars occurs as soon as the juices become slightly alkaline, that is at a *pH* above 7, this change being accompanied by a decrease in the copper reducing value, and an increase of colour, total acidity, and calcium salts. One of the first reactions that takes place as soon as a hexose sugar is added to an alkaline medium is a mutual conversion; and whether one starts with glucose, fructose, or mannose there is formed in every case a mixture of the three sugars in equilibrium. This conversion was first called attention to by Lobry de Bruyn and Alberda van Ekenstein,[1] who also found that two other sugars are formed, namely 2-ketose, termed pseudo-fructose, and a mixture of 3-ketohexoses, known as glutose. Glutose is absent in fresh raw juice, having been shown by the present author to be formed during manufacture, finally to accumulate in the molasses to the extent of 5 to 12 per cent. Usually the content of reducing sugars in molasses is calculated from the reducing power with the aid of a table applying to pure glucose or pure invert sugar, giving a result of 20-30 per cent. of total invert sugar. But as this result includes a product with only half the reducing power of invert sugar, there must be present a percentage of reducing sugars higher than is calculated. Consequently all figures giving the content of invert sugar in molasses are about 10-20 per cent. too low. This fact must be remembered always when theories on the exhaustion of molasses are based on determinations of the solubility of sucrose in invert sugar solutions.

Turning now to the acids formed as the result of increasing the alkalinity and the temperature, strictly speaking one should never carry the *pH* above 7, nor should

[1] *Rec. des Trav. Chim. Pays-bas,* 1895, **14**, 156, 203; 1896, **15**, 92; 1897, **16**, 257, 262, 274.

the temperature be raised, which of course is impossible in practice. Glucose decomposition must be expected to a greater or less extent, though it is desirable to fix the conditions under which it is as slight as possible. A reaction can be retarded by adding a negative catalyst, and practice appears to have found such a substance in sulphur dioxide and its salts. One molecule of glucose may give rise to one of saccharinic acid and to 2 of lactic acid; and if it is possible to direct the reaction in such a way that the first acid is formed instead of the second the total quantity of acid may be reduced to 50 per cent. Saccharinic acid may influence analytical results. It and its salts show a slightly negative optical rotation, whereas the lactone shows a positive one about 1½ times as great as does sucrose. By acids the salt is slowly converted into the lactone form, the consequence of which is that the sucrose will be found too low. Saccharinic acid is present in cane molasses. Lastly, the author considers the amount of decomposition suffered by reducing sugars in the factory. Java mutual control returns indicate for 1912 differences from 10·4 to 43·7 for carbonatation, 4·2 to 38·4 for sulphitation; and 1·1 to 37·7 for defecation factories. These figures show considerable differences from factory to factory. It is just such differences under varying conditions that make it desirable for the factors to be studied, so that all may attain to the lowest decomposition possible. Work is now being done at the Java Experiment Station, Pasoeroean, on the subject.

REMOVAL OF COLLOIDS WITH BENTONITE. **R. E. Lothrop and H. S. Paine.** *Paper read before the American Chemical Society (Sugar Division), Cincinnatti Meeting.* Cataphoresis measurements show that the colloidal particles of most honeys are positively charged and that reversal of the charge can be brought about by increasing the *pH* of the solution. An iso-electric point is reached when the particles show no charge, and at this point maximum precipitation of colloidal material takes place. Determinations of the iso-electric point gave very nearly the same value, namely *pH* 4·3. Above this the colloidal particles are negatively charged, and below positively. Coagulation of colloids can be brought about by the addition of Bentonite, a colloidal clay whose particles are negatively charged. The action is one of mutual precipitation of oppositely charged colloids, and results in a brilliantly clear honey, which is lighter than the original honey in colour. This process for "clarifying" honey promises to be valuable as a means of bettering the quality of some low-grade honeys.—WOOD SUGAR PRODUCTION BY THE BERGIUS PROCESS. **Erich Gundermann.** *Centr. Zuckerind.*, 1930, **38**, 593-597. The possibility of using a small amount of hydrochloric acid for conversion, and of being able to recover that not utilized, are two main points of superiority of this process compared with others making wood sugar, the main steps being: Subdividing and drying the wood; its "diffusion" with HCl for the hydrolysis of the sugars; evaporation and HCl recovery; and desiccation of the syrup. A powder is obtained containing: water, 13-15; pure carbohydrates (glucose, mannose, xylose, galactose, etc.), 70 per cent.; other digestible organic substance, 7-10; and ash and indigestible organic matters, 7-10 per cent. Its sweetening power is not comparable with that of sucrose, but as a cheap carbohydrate for animal foods it has possibilities when higher sugar prices prevail.—PREPARATION OF ASBESTOS FOR USE AS A LABORATORY FILTER-AID. **J. F. Brewster and F. P. Phelps.** *Ind. & Eng. Chem.*, 1930, **2**, No. 4, 373. Purified asbestos is a suitable medium for the clarification and filtration of turbid sugar solutions for colorimetric analysis, in that it causes little or no modification of the colouring matter and no loss by adsorption. Colloidal impurities along with iron oxide are removed and the material otherwise purified as follows: 25 grms. are boiled for 30 mins. with 250 c.c. of sodium hydroxide sp. gr. 1·284 using a nickel or iron vessel, or Pyrex round flask; filtered hot by suction; washed repeatedly with hot water; transferred to a flask; heated with 250 c.c. of HCl, sp. gr. 1·20 and 25 c.c. of nitric acid, sp. gr. 1·42 for 30 mins. in the water-bath, filtered by suction as before, and washed repeatedly with hot distilled water until all acid is removed. It is lastly dried in an oven at 110°C., and stored in clean glass container.

J. P. O.

Review of Recent Patents.[1]

UNITED STATES.

Crystallizer. **William G. Hall** (assignor of one-half to **Roy C. Pitcairn**, of Honolulu, T.H.). 1,769,779. July 1st, 1930.

It has been found in practice that by operating a crystallizer only partly filled with massecuite and permitting the stirring apparatus to operate approximately half in and half out of the liquor, crystallization takes place much more rapidly than when the crystallizer is filled to capacity and the stirring apparatus is completely submerged in the liquor. While this results in expediting crystallization, the advantage is somewhat offset by the reduction in the output of a given crystallizer which is operated at only about half capacity. The present invention is designed to provide a crystallizer of the stirrer type that will maintain the proper circulation of the liquor in the tank and will also include the advantageous operation of the partially submerged stirrer, which picks up the liquor from the tank, carries the same through the air above or in the upper part of the tank and drops it back in the form of thin sheets or streams into the tank, thereby effecting the rapid and uniform cooling necessary to expedite the formation of the sugar crystals. A relatively simple form of apparatus involving the invention is shown, in which 1 represents the tank of the crystallizer, which is provided with an open top. Journaled in bearings 2, 2 in the lower part of the tank is a horizontal shaft 4 carrying a helical stirrer 8, preferably in the form of a sheet metal strip attached to the shaft at intervals by means of radial arms 6 and clamping collars 7. Mounted in similar journal bearings 3 located near the top of the tank is a second shaft 10 which carries a second stirrer and liquor elevator, which, as shown, is made of a strip of T-iron or two sections of L-iron connected together to provide relatively extensive surface areas, which, in passing through the liquor, will pick up and carry portions of the liquor into the air above and drop the same in thin streams or sheets back into the tank. The two helical stirrers are so disposed that the successive curved portions thereof intermesh as the stirrers rotate and uniform rotary motion is imparted to each by suitable gearing, exemplified in the present case by intermeshing gears 14 and 15 of the same size, the gear 14 being driven by a worm 16. In operating the crystallizer, the tank is filled to capacity, so that the lower helical stirrer operates in completely submerged relation, while the upper stirrer is only partly submerged, so that, as the helical blade rotates, it operates to pick up portions of the liquor, pass the same through the air and drop it in the form of thin sheets or streams back into the tank, with the result that the liquor is rapidly and uniformly cooled and the crystallization of the sugar therein commensurately expedited. Instead of forming the helical portion of the upper stirrer of a T-cross section, as shown, the helical member may be formed of a series of spaced parallel blades or strips 13 with their edges normal to the axis of rotation, which will largely increase the lifting and carrying capacity of the stirrer blade and insure the liquor being dropped from the stirrer, as the latter passes through the air in the form of thin sheets or streams, which will still further accelerate the uniform cooling of the liquor.

Raw Sugar Conveyor (Binning Raw Sugar from Bags at Refineries). **William H. Hoodless**, of Philadelphia, Pa. 1,764,100. June 17th, 1930.

Raw sugar reaches the refinery in cargo lots in steamships. The practice prevailing at refineries is to store this sugar in bulk in large bins, removing it from the bags before storing it. From the bins it is withdrawn as needed for the processes of refining. Usually the raw sugar bins are placed above the ground floor of the refinery. The place of unloading the bags from the ship or car is generally at quite a distance

[1] Copies of specifications of patents with their drawings can be obtained on application to the following—*United Kingdom*: Patent Office, Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2 (price 1s. each). Abstracts of United Kingdom patents marked in our Review with a star (*) are reproduced from the *Illustrated Official Journal* (*Patents*), with the permission of the Controller of H.M. Stationery Office, London. Sometimes only the drawing or drawings are so reproduced. *United States*: Commissioner of Patents, Washington, D.C. (price 10 cents each). *France*: L'Imprimerie Nationale, 87, rue Vieille, du Temple, Paris. *Germany*: Patentamt, Berlin, Germany.

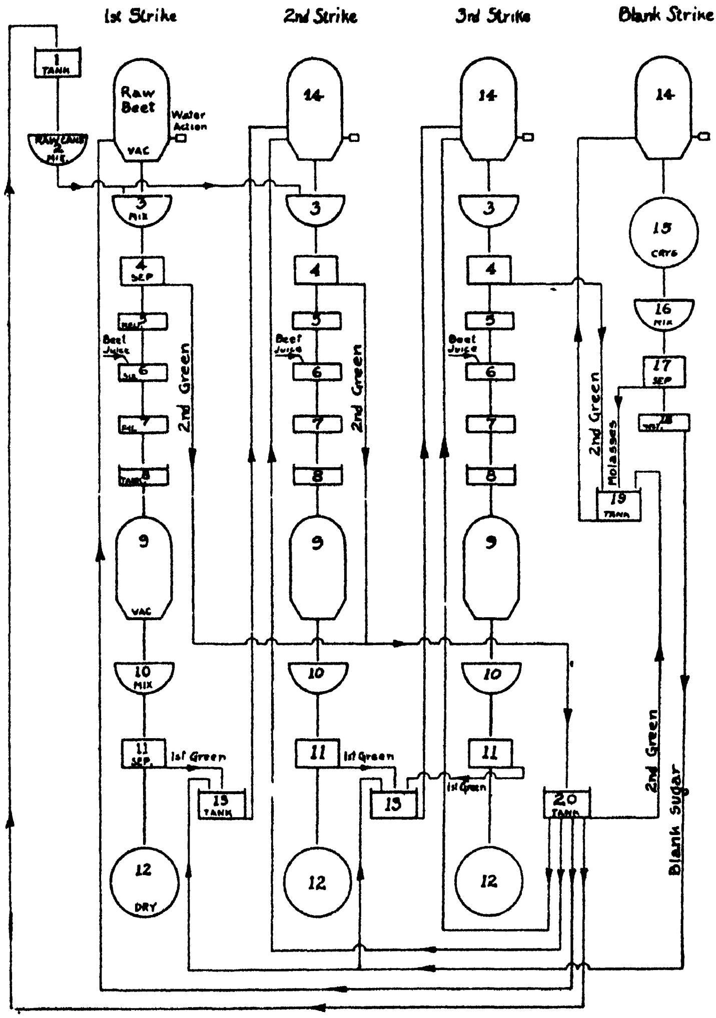
from the bins. Heretofore these bags containing the raw sugar were carried by travelling cranes or even by hand trucks to the mouth of a bin. The cord closing the mouth of the bags was cut by hand, and the bags lifted by main strength and emptied into the bin. The bags, which are customarily of a few standard sizes, are all heavy, and the work of lifting them is exhausting and slow, and requires many hands. Men frequently break down when employed at this work. By the inventor's device the bags are received by his conveyor first on a feeding apron, which is power driven, the movement of which is under the control of an operator who can stop or cause it to move independently of the movement of a main conveying apron, which is normally in continuous movement. This feeding apron furnishes means for distributing the bags singly or in convenient groupings along the main apron and is located at a convenient place in practice near the receiving end of the main apron for this purpose. The bags usually must be deposited on the feeding apron in irregular heaps, and as the conveyor will work more efficiently when the bags are distributed along the main apron fairly evenly, the value of the feeding apron is apparent. The main apron carries the bags that it receives from the feeding apron to the vicinity of the bins, and, at this point, the bags are gripped near their bottoms by movable carriers, while they are lying on the main apron, and are drawn over a downwardly inclined surface; whereupon the bottom of bag is lifted gradually by the carriers, the sugar being emptied from each bag as its bottom is lifted, until the bag is emptied. The empty bag can then be disengaged from the carrier. The inclined surface is furnished, in practice, by an auxiliary apron placed adjacent to the main belt. This auxiliary apron can form the bottom of an inclined chute down which the sugar will flow. The discharged sugar passes down the inclined apron. This arrangement of the inclined apron and bag carriers obviates the jarring that otherwise would happen, were the bags' weight thrown upon the bag carriers suddenly at the discharge end of the main apron. The conveyor substitutes machine work for the heavy labour of unloading and hastens the carrying and storage of raw sugar. It obviates considerable crude, expensive and dangerous agencies like the long distance travelling cranes, and the labour required to be performed manually with it in use is directive, the hardest labour being occasional manual adjustment of the bags upon the main apron, which is many times easier than lifting the bags.

PRODUCTION OF GRANULATED FROM BEET JUICE AND RAW CANE SUGAR. **Rudolph E. Pospisil** (assignor to **Edmund Kurek**), of Chippewa Falls, Wisconsin, U.S.A. 1,772,911. August 12th, 1930.

Objects of the invention are stated to be to operate over an extended season, thus prolonging the usual length of the beet campaign; and to produce white granulated from raw cane without the use of bonechar filters. It is an amplification of a process covered in a previous specification.[1] For obtaining the first strike of white granulated sugar, second green syrup obtained from a later stage in the process contained in tank 1 is drawn into the mixer 2 containing raw cane sugar, is mixed, but not thinned. This massecuite is pumped to mixer 3, where it meets high raw beet massecuite from pan 14 corresponding with one of the vacuum pans of the prior patent using water action to expel impurities and raise the purity of the massecuite. The cane and beet massecuites mixed in mixer 3 are passed through centrifugal 4; crystals testing 98° purity are melted in 5 to 30° Bé. and pumped to sulphur station 6, where fresh beet juice is added. These are mixed together, bleached, and neutralized and passed through mechanical filters 7 into tank 8, from which they are drawn into vacuum pan 9 and boiled to a massecuite. This massecuite is dropped into mixer 10 and then into centrifugal separator 11, where it is washed with pure water and the crystals dried in 12 to produce the first strike pure granulated white sugar. The second green syrup from centrifugal separator 4 is pumped to the tank 20, to be used for the next raw strike and the first green syrup from centrifugal separator 11 is collected in tank 13 to be used in the 2nd strike. For obtaining the

[1] U.S. Patent, 1,352,084; *I.S.J.*, 1921, 58.

2nd strike of white granulated, green syrup is pumped from tank 13 into pan 14, with blank sugar from the last strike of the process and also second green syrup from tank 20, mixed together in vacuum pan 14 to form crystals and boiled to massecuite with rapid water injections. This massecuite is dropped to mixer 3, after which the course is as shown in the drawing. The first green syrup from the 2nd strike and sugar from the blank strike will meet together in tank 13 and be pumped to vacuum pan 14 for the third strike. There is also pumped to this vacuum pan from tank 20 the second green syrup from the 1st and 2nd strikes. These



syrups are boiled together in the vacuum pan 14 and are subjected to the water injection repeatedly until the massecuite is finished and it is then dropped into the mixer 3 after which operations are as shown in the drawing, the 3rd strike of white sugar thus being completed. The first green syrup from the 3rd strike is collected in tank 13 while the second green syrup together with second green syrup from tank 20 is pumped to tank 19 from which it is drawn into vacuum pan 14 for the blank strike. Here it is boiled to a density of 93 to 94°Brix. This massecuite is dropped into crystallizers 15 to remain for approximately 5 days to be crystallized, being then

dropped into mixer 16 and through the centrifugal 17 to separate the crystals which are melted in melter 18 to 30° Bé. to constitute the blank sugar conducted to tank 13 to meet the first green syrup for use in the second and third strikes. This blank sugar is dark and is repeatedly melted and continually boiled over again for high raw massecuite. The molasses from the blank strike is drawn into tank 19 where it meets with the second green syrup from the 3rd strike and with the second green syrup from the first and second strikes, from the tank 20, and this mixture is boiled in vacuum pan 14 to repeat the blank strike again and again, the purity of the molasses being raised by the addition of the green syrup to permit the recovery of additional blank sugar to be worked into the process for producing white granulated sugar as described.

PRODUCTION, APPLICATION AND REVIVIFICATION OF ACTIVATED (DECOLORIZING) CARBON. (*A*) **Hans von Halban and Oskar Schober** (assignors to the **Metallgesellschaft,** of Frankfort-on-the-Main, Germany). 1,744,341. August 26th, 1930. (*B*) **Oscar L. Barnebey,** of Columbus, Ohio. 1,774,585. September 2nd, 1930. (*C*) **Richard Threfall,** of Birmingham, England. October 7th, 1930. (*D*) **Edouard Urbain** (assignor to **Urbain Corporation,** of Delaware). 1,778,343. October 14th, 1930.

(*A*) An active carbon product containing from about 20 to about 90 per cent. of ash derived from the carbonaceous starting material, which ash is soluble in dilute hydrochloric acid. (*B*) The process of manufacturing decolorizing and adsorbent carbon, comprising carbonizing carbonaceous material, extracting soluble material therefrom with a solvent consisting of an organic nitrogen compound, heating the carbonized material with oxygenated gases to increase its porosity and adsorptive capacity, and removing ash constituents from the carbon. (*C*) A method of reproducing activated charcoal comprises heating charcoal with sulphur, subsequently treating the charcoal to remove sulphur and finally heating the charcoal in an atmosphere of hydrogen at a high temperature. (*D*) A method of activating carbon comprises the step of treating the carbon at a temperature above 350°C. with phosphorus vapours.

BEET HARVESTER. **David E. Feltman,** of Ottawa, Ohio. 1,779,308. October 21st, 1930. A beet harvesting machine comprises a pair of side frame bars having intermediate horizontal portions merging at their rear ends in downwardly and rearwardly inclined extensions and at their forward ends in a horizontal ring, a receptacle between the extensions, an axle bar across the extensions merging at its end in uprights terminating in outwardly directed journals, wheels on the journals, a ring rotatable in the first mentioned ring, standards depending from diametrically opposite points of the second mentioned ring, an axle on the lower ends of the standards, a frame fixed to the second mentioned ring and projecting beyond the rings, a trough rockably mounted in the frame, digging means at one end of the trough, conveyor means in the trough, means for tilting the trough, wheels on the axle, and means operatively connecting one of the second mentioned wheels with the conveyor means. —PRODUCTION OF A FERMENT. **Wincenty Matzka,** London. 1,781,788. November 18th, 1930. A process for the production of a ferment for the fermentation of the aqueous saccharine extract from waste vegetable raw material containing sugar which comprises treating said waste vegetable raw material to obtain an aqueous extract, supplying approximately 12 per cent. of alcohol to said extract, inoculating said extract with a small quantity of alcohol-producing ferment, and then progressively adding to said extract sugar from another source to propagate said ferment while maintaining sugar concentration characteristic of said vegetable material and alcohol concentration approximately constant, and stabilizing the ferment so propagated with alcohol, glycerine and a weak organic acid.

United States.

(*Willett & Gray.*)

(Total of 2,240 lbs.)	1930. Tons.		1929. Tons.
Total Receipts, Jan. 1st to Nov. 22nd	2,381,291	..	3,208,822
Deliveries „ „	2,672,319	..	2,854,861
Meltings by Refiners „ „	2,690,074	..	2,752,650
Exports of Refined „ „	42,000	..	81,000
Importers' Stocks, Nov. 22nd	146,243	..	452,192
Total Stocks, „	288,082	..	619,127
	1929.		1928.
Total Consumption for twelve months	5,810,980	..	5,542,636

Cuba.

STATEMENT OF EXPORTS AND STOCKS OF SUGAR, AT OCTOBER 31ST.

(Tons of 2,240 lbs.)	1928. Tons.		1929. Tons.		1930. Tons.
Exports	3,188,371	..	4,266,692	..	2,355,976
Stocks	459,519	..	374,364	..	1,007,346
	3,647,890	..	4,641,056	..	3,363,322
Local Consumption..	60,130	..	93,950	..	69,628
Receipts at Ports to October 31st. ..	3,708,020	..	4,735,006	..	3,432,950

Habana, October 31st, 1930. J. GUMA.—L. MEJER.

Beet Sugar Production of Europe.

In Raw Value and Metric Tons.

(*F. O. Licht's Estimate at November 30th,* 1930).

	1930-31. 3rd estimate. Tons.		1929-30. Tons.		1928-29. Tons.
Germany	2,425,000	..	1,966,782	..	1,851,263
Czecho-Slovakia	1,150,000	..	1,022,116	..	1,042,948
Austria	140,000	..	120,391	..	107,322
Hungary	225,000	..	246,831	..	220,062
France	1,125,000	..	909,622	..	903,075
Belgium	275,000	..	252,048	..	279,290
Holland	300,000	..	264,871	..	319,937
Denmark	165,000	..	134,300	.	170,000
Sweden	170,000	..	121,404	..	160,860
Poland	750,000	..	928,776	..	756,889
Italy	415,000	..	415,169	..	367,334
Spain	290,000	..	273,955	..	262,000
Dantzig	40,000	..	30,000	..	30,000
Jugoslavia	95,000	..	131,639	..	129,000
Roumania	120,000	..	82,230	..	130,000
Bulgaria	55,000	..	41,007	..	29,870
Switzerland	7,000	..	7,000	..	7,000
England, Scotland, and Wales	465,000	..	331,116	..	222,590
Irish Free State	24,000	..	21,100	..	22,500
Finland	3,000	..	2,814	..	3,387
Latvia	7,000	..	3,339	..	2,000
Turkey	9,000	..	5,350	..	4,000
Europe without Russia	8,255,000	..	7,311,860	..	7,021,327
Russia	2,000,000	..	950,000	..	1,446,000
Europe including Russia	10,255,000	..	8,261,860	..	8,467,327

United Kingdom Monthly Sugar Report.

Our last report was dated 11th November.

The Markets have been rather unsettled during the period under review. Although the Cuban Senate definitely passed a Bill to segregate 1,500,000 tons under the CHADBOURNE plan and the Cuban American deputation came over to Europe, considerable doubt was felt in sugar circles as to whether an international agreement could be reached.

However, during the last few days Cuba has come to an understanding with Java in Amsterdam and a conference with the European producers is opening in Brussels to-morrow. Java apparently is limiting her exports to 2,300,000 tons and will segregate 500,000 tons to be marketed over the next five years.

Cuba at the same time agrees to restrict her crop to 3,570,000 tons. It is rumoured that the principal markets in Europe are all willing to reduce their sowings next year, but the essential problem of fixing the exporting quota for Germany, Czecho-Slovakia and Poland will present considerable difficulties.

The London Terminal Market on the whole is lower than a month ago, but considerable business has taken place. December fell on liquidation and at one moment touched 4s. 5d., but to-day it has recovered to 5s. 2d., March moved from 6s. 6½d. to 5s. 10½d. to 6s. 5d., May from 6s. 9¾d. to 6s. 1d. to 6s. 7d., August from 7s. 0¾d. to 6s. 4d. to 6s. 10d., whilst December, 1931, moved from 7s. 2¼d. to 6s. 7½d. to 7s. 2d.

The White Terminal Market has been stagnant and very little business transpired. The latest prices are :—

	DECEMBER	MARCH	MAY	AUGUST
Raw	5s. 2d. ..	6s. 5d. ..	6s. 7d. ..	6s. 10d.
White	7s. 9d. ..	7s. 10½d...	8s. 1½d. ..	—

Refined has been very slow of sale and the trade have continued to exist on minimum purchases. The Refiners made a series of reductions at 3d. per cwt. on each of the following dates, November 11th, 18th, 19th, 20th, 22nd, but on December 1st they advanced their price by 3d. per cwt., the latest prices being No. 1 Cubes 23s., London Granulated 19s. 4½d.

Home Grown Factories moved their prices in sympathy with the Refiners and their latest prices are 18s. 6d. to 19s. 3d. according to factory and delivery.

Business in Raws is still confined to small lots of Cubans and Perus and Mauritius at 6s. 1½d. to 6s. c.i.f.

There is no fresh news from Cuba, but offers are very scarce.

With regard to Europe the crop is better than previously expected and LICHT has increased his estimate for Russia by 240,000 tons and other European markets by 270,000 tons. His total to-day, including Russia, is 10,255,000 tons, against last year's production of 8,262,000 tons.

21, Mincing Lane,
London, E.C.3.
9th December, 1930.

ARTHUR B. HODGE,
Sugar Merchants & Brokers.

THE

INTERNATIONAL SUGAR JOURNAL.

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The Editors will be glad to consider any MSS. sent to them for insertion in this Journal, and will endeavour to return the same if unsuitable; but they cannot undertake to be responsible for them unless a stamped addressed envelope is enclosed.

No. 375. MARCH, 1930. Vol. XXXII.

Notes and Comments.

The Outlook.

The sugar market has remained depressed the past month, nominal quotations having gone even lower than previously. Unsettling features are: the uncertainty regarding the British Budget due to be unfolded on April 14th; the question whether the Cuban Single Seller is going to win the day; the fact that though production this year is now estimated at some 660,000 tons less, we are still under the cloud of an increased visible carry-over into this year, so that improvement foreshadowed on paper is in practice only likely to be gradually achieved. But at any rate the omens, such as they are, do point to an improvement and even if 1930 turns out a bit of a disappointment, it will not be long now ere estimates with regard to 1931 begin to formulate. If these show no increases over 1930, or if, what is better, they reflect in further decreases the unprofitableness of current crop prices, the relation of consumption to production will be bound to show a marked improvement and we may get rid at long last of the incubus of an excessive amount of visibles.

Rumours have been rather busy the past month as to what was going to happen in Cuba, where the Single Seller is not without its critics, and some parties would like to see it dispensed with. The Government were considering the question of restriction with regard to the present crop to the extent of 10 or 20 per cent., and the prohibition of re-plantings. However, a meeting of planters representing 102 centrals voted unanimously against any restriction of this season's production. On the other hand, the Single Seller has stated that the majority of the planters have voted for maintenance of the single selling arrangement. So providing it can satisfactorily finance its operations, it will doubtless continue to hold its sugar off the market till the duty-free sugar season is over and the States have serious need to buy Cuban sugar. By that time, too, the British refiners will probably be in the market for appreciable amounts.

Amongst rumours flying about has lately been one that Cuba and Java were about to agree to a five-year limit of production. It is unlikely to have much basis in fact. But undoubtedly conditions are changing somewhat for the worse for Java, and one of these days she may decide that the time is propitious for some understanding with other big sugar producers, even as her rubber growers have just lately reversed their previous policy of isolation and

have agreed with their British confrères to restrict rubber tapping for a month. We learn that up to now only 130,000 tons of the next Java crop has been sold, whereas in former seasons the whole crop used to find purchasers before the mills had started in May. Then a long drought has been experienced in the Island and has caused the cane to suffer seriously. The coming crop may therefore be at least 5 per cent. less than that reaped in 1929, while 1931 promises no better. It would seem, then, that the high water mark registered in 1928 in Java is not likely to be equalled for some time to come, much less to be exceeded.

The Geneva discussions over a proposed Customs holiday in Europe have proved fruitless and it is doubtful whether anything more will be heard of it. A considerable body of opinion in this country was naturally opposed to stabilizing general tariffs against us at their present levels. However, with this abortive attempt goes the sectional proposal relating to a holiday for sugar duties. There is no chance of getting the countries concerned to agree to leave their sugar duties at the present rates, much less to lower them, so the solution of the sugar problem must be sought elsewhere than through Government action.

The Government and the West Indian Crisis.

In the first week in March we are still without any intimation from the Labour Government as to their intentions with regard to assisting the British West Indian and Mauritius sugar colonies. They have not even at the moment of writing published the Olivier Commission Report, though it has been in the hands of the Government over one month and a summary of it has been available for their prior consideration for over two months. Meantime these colonies, after just surviving a year of unprecedentedly low prices, for which the existing preference has proved inadequate, have started to reap a second crop with no certainty of finding a market for it save at a loss. Fears as to the Budget in April have had a deadening effect on sugar business, and no colonial sugars are bought for future delivery save on the conditions that any change in the preference shall be adjusted in the price. Meanwhile, there are no facilities for storage of the new crop sugar, so it is bound to be thrown on the market at a price showing a heavy loss. The *Times* of March 4th had a very strong leader on the subject, stigmatizing the Government's procrastination as a conspiracy of silence, and likening it to a bomb with a delayed action.

The origin of all the trouble was of course Mr. SNOWDEN'S ill-advised remark last summer when outlining Labour fiscal policy, that he hoped before leaving office to sweep away all duties on sugar. Faced with the difficulties that would result to the West Indies from any such action, he subsequently said that the Government were giving the matter their careful and sympathetic consideration, and were seeing whether it was possible to extend them some assistance to tide over present difficulties and to put them in a better financial and economic position to withstand future world competition. The outcome of this was the appointment of the West Indian Commission with Lord OLIVIER and Mr. SEMPLE to investigate matters. The Government may have fondly imagined that the report would indicate exaggerated alarm and a lack of up-to-dateness that would explain everything. Instead, there is quite enough known by now of the tenour of the actual report submitted to put quite a different complexion on the matter. Lord OLIVIER (himself a Labour man) has since his return been uncompromising in his warning of the desperate plight to which the West Indian sugar industry has been brought, not by any

fault of its own but by the abnormal condition in the world sugar trade. But the Government, after having ample time to digest the cold facts, continue to deny the country even the sight of the Report ; as for letting the West Indies know what aid is or is not pending, Mr. SNOWDEN can say no more that that if the sugar duties are continued, the preference will likewise; but he maintains a stony silence as to his intentions with regard to the duties, and as late as the 4th of March reiterated his intention not to antedate the Budget announcement.

It has been stated that the average cost of producing sugar in the British West Indies is about 13s per cwt., f.o.b. the islands. On the basis of to-day's price of about 10s. f.o.b., for preferential 96° centrifugals, the loss under the assumed average cost of production works out at £3 per ton. In Trinidad where the cost of production is under the average they are anticipating a loss of at least £2. 10s. per ton on the current crop—even with the preference. If the preference be abolished the sugar would have to sell on a footing of equality with Peruvians and Brazilians at something like 6s. 6d. f.o.b. or say half the cost price. It is clear, then, that not only is the continuation of the preference absolutely necessary, but to give the British West Indies a chance to make a reasonable profit, an increase in the preference to the full amount of the duty would be justified as a temporary measure at least.

The World Statistical Position.

Messrs. LAMBORN & Co. of New York have lately published their annual estimate of sugar production and consumption, for the year ending next August 31st. The world production of sugar for 1929-30, they put at 27,252,000 long tons, raw sugar value. This compares with an actual production for 1928-29 of 28,057,000 long tons, a decrease of 805,000 tons, or 2·87 per cent. Consumption of sugar for 1929-30 is estimated at 27,837,000 long tons, raw sugar value. This represents an increase of 870,000 tons, equivalent to 3·2 per cent., over consumption of last year. Should the decrease of 2·87 per cent. in world production, and the increase of 3·22 per cent. in world consumption be attained, it would necessitate a reduction in the world's surplus stocks of approximately 585,000 long tons.

The table following shows, by geographical divisions, the estimates of production and consumption for 1929-30 as compared wih the actual figures for 1928-29. It is to be noted that decreases in production are expected to occur in all of the continental groups. The principal reductions are in North America (occasioned by the anticipated decrease in the Cuban outturn, and in Asia where a reduced Javan crop is indicated). Europe as a whole, due to this year's small Russian crop, also shows a falling off in production.

WORLD SUGAR PRODUCTION AND CONSUMPTION
(in long tons—raw sugar value)

	Production		Consumption	
	1929-30	1928-29	1929-30	1928-29
North America	8,379,000	8,686,000	7,587,000	7,301,000
South America	1,744,000	1,792,000	1,549,000	1,509,000
Europe	8,208,000	8,353,000	10,349,000	9,917,000
Asia	7,560,000	7,836,000	7,185,000	7,094,000
Africa	761,000	776,000	726,000	710,000
Oceania	600,000	614,000	441,000	436,000
World Total	27,252,000	28,057,000	27,837,000	26,967,000

United Kingdom Sugar Consumption, 1929.

Last month we gave the details of imported sugar consumption within the United Kingdom, for the calendar year 1929, as shown by the Board of Trade figures. The details of home grown sugar are now available and show that we produced in this country 234,742 tons of beet sugar as compared with 186,175 tons in 1928.

It is thus possible to estimate the total consumption. But in respect to the Board of Trade figures of 1,946,229 tons of imported sugar—equal to 1,952,034 tons raw value, Messrs. CZARNIKOW, our leading sugar statisticians, point out that an allowance has to be made for Exports since April 25th, 1928, of British Refined manufactured from Raws returned as "Consumption," and that the net quantity in terms of raw value is 1,778,625 tons. Adding to this the home production, estimated as raws at 258,216 tons, they arrive at the grand total of 2,036,841 tons, raw value, for the sugar consumption of the Kingdom for 1929, which compares with 2,016,015 tons[1] in 1928, and 1,868,110 tons in 1927. Messrs. CZARNIKOW remark that it is worthy of note that the past year's total exceeds the figure of 1928 by some 20,000 tons, in spite of the fact that in 1928 the withdrawals were increased by the alteration in the method of collection of duties as a result of the changes in the tariff.

On the basis of the present officially estimated population of 45¾ millions the 1929 total works out at 99·7 lbs. raw value per head, which compares, on the same population basis, with 98·7 lbs. in 1928.

American Sugar Politics.

It is somewhat difficult for a non-American to gauge the true inwardness of recent American sugar politics, especially in relation to the long fight to fix the new sugar duties under the HAWLEY Tariff Bill. The *Literary Digest* of New York recently gave its readers a sketch of some points at issue, and from it we glean the following features of the situation.

The protagonists in the fight for and against the raising of the sugar duties were the domestic sugar producers (comprising the beet sugar industry of the western States and the Louisiana cane sugar industry) and the American capitalists owning the best part of the Cuban sugar industry. The former are said to have a total of 250 million dollars invested in the business, of which seven-eighths relates to the beet sugar interests. It was therefore a bitter pill for these domestic producers when the Senate not only turned down the House proposal to fix the new duties on Cuban and foreign sugar respectively at 2·40 and 3 cents., but even rejected the proposals of Senator SMOOT and the Senate Financial Committee that the rates should be 2·20 and 2·75 cents. Instead, the Senate voted by 48 to 38 for the continuance of the existing tariff of 1·76 and 2·20 cents., and those organs of American opinion not associated with the sugar industry hailed this as a victory for the consumer which was estimated to save them 54 million dollars a year. At the time of writing the final decision of Congress has yet to be taken and it is not certain whether a compromise will be effected in the end or whether the Senate will stick to its guns and refuse to vote any increase in the sugar duties. This last seems the more likely in that with the shadow of approaching elections the opinion of the American housewife cannot be ignored, and domestic opinion seems opposed to any increase, actual or threatened, in the price of sugar.[2]

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1 This figure is some 40,000 tons less than as given by us last year, and represents the adjustment owing to the re-export of sugars entered as "consumption."

2 As we go to press, news comes to hand which suggests that a compromise has been effected. The Senate has now voted an increase in the tariff on Cuban raws from 1·76 to 2 cents per lb. If this is ratified, the moderates have still the best of it.

Another prospective tax turned down by the Senate was a proposal by a Nebraska Senator that a bounty of 0·44 cent per lb. should be paid on sugar, 90 per cent. of it to go to the beet and cane raisers and 10 per cent. to the refiners. It was estimated to cost the country $10,600,000 a year. This proposal was defeated by 44 votes to 22. In this connexion, the *New York Times* remarks that the Senate's stand presages a bitter struggle to free the Philippines of American sovereignty, not on grounds of sentiment, but to remove the competition of the more cheaply produced Philippine sugar.

Two days before the Senate acted, the Lobby Investigation Committee, which had delved into the more or less surreptitious activities of the warring sugar lobbies, made its report. Incidentally, it pointed out that, roughly estimated, the cost to the contending forces of the fight waged over the tariff bill has been over $400,000, the cost to those in favour of the increased sugar duty being between $175,000 and $200,000, and the cost to the opponents between $200,000 and $220,000. The report is mainly concerned in absolving President HOOVER from taking any step open to censure or criticism in his relations with the advocates and opponents of the proposed sugar duties. But the investigation, coming when it did, had the fortunate effect of preventing it being said that the Senate had been bought up in giving its vote as it did. The exposure of the heavy expenditures of money by the sugar lobbyists was a prior event, and so left the Senate unscathed.

As above mentioned, opinion in the American Press was very widely favourable to the Senate's action and was hailed as a damaging blow to the system of high protective tariffs. But there were of course other commentators who deplored the lack of an adequate protection for the domestic sugar industry : it was emphasized that if the home industry were destroyed the people of the United States would be at the mercy of the Cuban monopolists. As for the Cuban interests themselves, they were naturally elated at the Senate's stand against higher duties, and regarded it as a godsend to their party.

The Ineptitude of Politicians.

But whatever view be taken as to the need or otherwise for an increase in the American tariff on sugar, there seems no question that, as *Facts about Sugar* points out, the dillydallying tactics pursued in dealing with the tariff bill (which soon will have been a full year before Congress) have seriously affected many lines of trade and industry and have had an unsettling effect on business generally. In the sugar trade the interminable delay has resulted in the piling up of imported stocks in Americn ports, to be held there month after month while waiting for final action on the sugar duty, and this has contributed much to the present unsatisfactory market situation.

It thus happens that in the two leading sugar market centres of the world, political ineptitude has caused intolerable disturbance and loss to the trade over a period running into months : in America because the politicians seemingly cannot make up their minds quickly as to the proper thing to do, and (we may add) are probably not allowed by interested parties to exercise their minds free of lobbying influences ; in England, because the old heresy of free trade (that is free exchange of goods) is so deep in the blood of some politicians that they are quite unable to realize that it is an impracticable proposition in the present conditions of world trade, and instead of leaving well alone they make trade a hostage to their economic theories.

The Cuban Sugar Crop of 1930.

A correspondent in Havana writes that when the last Cuban sugar crop terminated it was generally expected that prices of raw sugar would improve a little and that the outlook would be better. But those expectations have not come to pass, and the position to-day is far from being a promising one from the planter's point of view. The independent cane farmers in Cuba are in such a position financially that they have not been able to give their cane fields the cultivation necessary in order to keep them up to normal production, and the result is that large areas of cane are being gradually abandoned. The fields of cane are being allowed to run to grass when the amount of cane per acre is not sufficient to make it worth while to attend to them as a cane crop. In this way great areas of cane are gradually going out of cultivation, and the independent farmer is, perforce, disappearing from the cane growing industry. With an improvement in prices this trend will change ; but to-day that is the position. On the other hand, the farmers who have planting contracts with financially strong companies are in a much happier position, as their agricultural operations are being financed by those companies, so as to keep up the cane supply for their factories. Such companies with capital behind them are seeing to it that their cane acreage is being maintained and that their factories will have sufficient cane to keep them operating at full capacity during the crop season. Not only have they given their cane fields all the necessary attention for that purpose, but they have re-planted during the year just closed large areas in cane, and are outlining planting programmes for the coming year. They can do this, as they are more or less in a financial position to bridge over the present period of low sugar prices, whereas the independent cane farmer is not in that position, since the banks will now no longer assist him.

Various estimates have been made on the production of 96° raw sugar to be turned out during the crop just commenced. These range from 4,500,000 to 4,700,000 tons. It is conceded by reliable observers that the final output for the crop will be 4,500,000 tons, and perhaps a little more. The general belief is that there is cane enough for more than that amount, so, given favourable weather conditions for the harvesting, we can look for at least a 4½ million ton crop.

Argentine Affairs.

According to the Monthly Review of the Bank of London and South America, the Government of the province of Tucuman has at present under consideration a scheme relating to the manufacture of combustibles for motors, as a substitute for naphtha, chemical products, etc., from alcohol produced from the molasses not utilized by the mills after the sugar is extracted. The Provincial Executive is disposed to foster these industries and, it is said, will submit a measure to the local Legislature for the suppression of the tax on alcohol employed in the manufacture of the products mentioned. Meantime, it is understood, representations will be made to the National Government for the abolition or modification of the corresponding national tax. Press comments are inclined to assign considerable importance to this initiative, intensive industrialization of by-products being held to be a far more effective remedy for the somewhat depressed condition of the sugar industry than some of the many palliatives which have been suggested. Meanwhile, it is stated, the Provincial Executive has appointed a Committee to inquire into the low prices of this product at present ruling in the market,

for the depressed condition of the industry continues to be a matter of no little pre-occupation and whereas in some quarters hopes are entertained that better prospects will shortly be manifested, in others extreme pessimism continues to be the dominant note. In this respect, the cane growers have addressed a note to the President of the Republic, expressing the hope that the promises made to the Committee recently received in audience will be fulfilled. The present season's harvest, they state, was poor in comparison with that of the previous year and the coming crop, there is reason to believe, will be still worse, in spite of which, they allege, the sugar manufacturers continue to pay prices described as compatible only with super-production.

Java Plantation Work.[1]

Mr. W. W. G. MOIR has written an interesting paper on the Java sugar industry, as seen by him on a recent visit; and it is particularly valuable to have the observations of so keen a scientist, and one so well qualified by his long experience in the sugar industry in Hawaii. There is, it is true, an abundance of excellent descriptions by Java men, but these lack the element of surprise, which adds savour to a narrative, and which creeps in here and there in MOIR's study—with occasionally a very tentative and restrained criticism. This paper is too long to repeat in full, but some of the points are here reproduced, it being needless to say that the author does not attempt to generalize: "the description given may, or may not, pertain to the whole industry, and due allowance must be made for discrepancies which may manifest themselves in so very short a period of contact with Java plantations."

He opens the subject with a little general information in regard to the Java sugar industry as a whole. Nearly all the cane is raised by the "estates" themselves, the land being owned by the natives, and rented to the estates at fairly high rents, from $15 to $20 per acre. No ratoons are possible, because the land is also required for the food of the large population (700 to the square mile); and cane can only be grown for one year in every three. The lands adjacent or tributary to the estate must therefore be three times larger than the year's planting. Nearly all of them are irrigated, yet the land under cane only occupies 7 per cent. of the irrigated land of Java.

There are a few unirrigated lands, called *tegallans*, on which cane is grown, but these have a peculiar type of young volcanic soil, of good fertility and water retaining ability Irrigation is one of the most important factors in Java yields; and, although costly irrigation projects have been installed by the sugar interests, the greatest benefit from these is reaped by the native in his rice growing. Nearly all the cane areas are on wide, level or sloping plains, near the seashore or river banks, or on highland plateaus. The climate is very tropical, in comparison with that of Hawaiian conditions; but there are two very marked seasons: the west monsoon, from November to April, with rain and excessive heat, and the east monsoon, from May till November, with cooler and drier air. The annual rainfall in the cane belt varies from 50 to 130 in., lighter in the east and heavier in the west, but the average in all the sugar districts would be represented by about 60 in.

High forest-clad mountains extend the length of the island, and large rivers descend from them to the plains, bringing silt-laden irrigation water for the rice and canes. Much of the cane land has been formed in this way, and

1 Reports of the Association of Hawaiian Sugar Technologists. October 1929. A Java sugar plantation. W. W. G. MOIR.

is therefore alluvial and fertile ; but there are other soils in the tract, among which is a residual deposit formed from limestone appearing as a marl (lime-clay) which is infertile, but is found here and there cropping up and becoming mixed with the alluvia. The alluvial soils require little by way of mineral artificials, but are deficient in nitrogen, although as in most alluvia, they vary greatly from place to place. On the whole the Java soils show, on analysis, much higher phosphorus content and much lower potash than those in Hawaii. And yet, the experiments show response to small additions of the former and none at all when potash is added—which somewhat unusual results lead MOIR to a rather critical attitude to the methods employed.

After this introduction, he proceeds to summarize the advantages enjoyed by the Java sugar planters : (1) An extremely fertile soil, as none but the best are used, (2) an ideal climate, namely, hot and rainy during the growing period, and dry and cooler during harvesting, (3) an abundant supply of cheap labour, with no real housing and welfare problems, (4) a cheap and abundant supply of water, (5) a small amount of field operations, compared with Hawaii, and (6) no violent climatic changes : all of which materially aid in the intensive garden culture of cane raising, very little of which can be directly compared with Hawaiian practices and conditions.

The organization of the plantation staff is very similar to that of Hawaii — manager, assistant manager, section overseers, field chemist, chief engineer, factory chief, chemists and assistant engineers, book-keeping staff, transport and supply superintendents, etc.—but there is a great difference in the method of promotion from one position to another. In working up to the managership, a man will spend several years in the chemical department of the factory, passing duly to factory chief or assistant engineer, and finally to chief engineer in the factory ; he will then become in turn a field chemist, section overseer, assistant manager and at last manager.

The post of field chemist, or agriculturist as we should call it, is extremely important in training men in the field, and impressing on them the need of proving, by appropriate experiments, the value of any practice before adopting it ; besides which co-operation between experiment station and plantation is obtained. All the detailed work of the experiments is done by the agriculturist, leaving only the checking of operations, calculation of results, conclusions and summary to the local agent of the experiment station, or group adviser, as he is called. The agriculturist is of course on the plantation staff.

There are 15 group advisers in Java, each of which has 10 to 12 plantations under his supervision. These men are usually doctors of biology or agriculture, and are trained in all branches of agriculture research at the experiment station before being appointed. Their duties, besides those already mentioned, are : soil mapping, fertilizer mapping, visits and reports on plantations, general advice on all operations and conditions (disease, etc.) collecting data for the station, and making monthly reports on conditions, weather, etc., in their districts. All results of research secured at the station are turned over to them, and are out of the hands of the specialists as soon as the results are shown to be practical. Through these group advisers a very close relationship is maintained between station and field.

There are two general systems of preparing the land and growing the cane —the ploughing system and the Reynoso system. The former was the original native method and the latter has been introduced by the planters. The native used to give about five ploughings with the indigenous plough, ultimately working down to about 7 in., and then make the furrows for planting.

At present European ploughs are used, besides the native ones, and the depth of working is somewhat greater. Even tractors and steam ploughs are met with, but thus far the general opinion is that they are not economical, and they are rarely seen. This system is primarily used on land of too loose a texture for the Reynoso system ; but often, in times of labour scarcity at the height of the harvesting season, it is also used on heavier lands. On the whole, it is considered to be cheaper, but in practice often turns out to be more expensive and less productive. It is usual to contract for the work at $8 to $10 per acre, up to furrowing out and putting in the ditches and drains by hand.

In the Reynoso system the land is taken immediately after the rice harvest has been reaped. A ring drain is drawn around the field, and many transverse drains are added. Ditches, used as water courses as well as drains, are then put in, after which the trenches and furrows are excavatod. All this work is done by the spade, usually while the land is semi-flooded. The larger ditches and the furrows usually run from north to south on flat, but follow the contours on sloping land. The actual trench (furrow ?) in which planting is done will probably be 16-20 in. wide, while the ridges between will be from 20-30 in.

The depth of the furrow at planting time depends on whether the bottom is merely loosened or the loose earth is all lifted out, and thus may vary from 12 to 18 in. All the soil taken out is placed on the broad ridge and packed so that it will not fall in : the land is so compact that the straight-sided ditches and furrows remain firmly fixed for several months, during which the plants are growing and the lifted soil is gradually hoed on to the young canes. If there is loose soil at the bottom of the furrow, it is moved to make place for planting the set. The trenches are usually from 30 to 37 ft. long and at right angles to the water courses. To help in supervision and to carry in supplies, paths are left here and there. The whole lay-out, or the plan of trenching and furrowing, is very similar to that in Hawaii.

There are two phases in irrigation. At first, water does not enter the trenches, and the plants are irrigated by the "splash" method, tins being fixed to the ends of bamboos and water thus thrown over the young cane rows. This lasts till the furrows are filled in and the plants are already partly earthed up. Then the trenches are filled with water and the furrows are irrigated in the usual way. On reviewing the methods in Javan irrigation, it is natural that Moir compares the primitive practices employed unfavourably with those of Hawaii. He regards them as "extremely crude, wasteful of water, and harmful to the ground and the plant. However, for the type of labour used, the extremely small cost per acre (about 20c. gold) per irrigation, the fine drainage system to alleviate the damage done by over-irrigation, and the really short time in which irrigation is practised, the system is probably well suited to Java conditions."

The interval between irrigations is usually controlled by the amount of water allowed to the plantations, but is about 20 to 30 days on the average. The whole period lasts about 8 months, and at most there are from 10 to 12 irrigations during that time. The first few are extremely light, but the later ones are heavy. It would be very difficult to obtain exact figures, because the trenches are used both as drains and as watercourses, and because of the amount of water allowed to flow in and out of the field during irrigation.

The seed used and the methods of planting both show differences. Because of the sereh disease, seed was formerly obtained from hill seed farms,

the seed thus raised was sent to nurseries in the plains for multiplication and dispersal or sent direct to the plantations. But, with the arrival of POJ 2878 which is immune to this disease, the hill plantations have ceased to be important. The ideal time for planting is in April, just after the cessation of the rains; but in practice it spreads on till July, for the harvesting season only starts in May-June. Therefore body seed is raised in plains nurseries, the two top seed pieces from each stalk being first used; but the stalks are left in the ground and allowed to sprout, and when their shoots are about a foot long, they are cut off, tied in bundles and carried to the fields. These are called *rajoengans*, and when the leaves are trimmed they are planted. This process is allowed to continue till the whole of the stalk is used up.

Planting is done by women and children on contract; including bringing the bundles of shoots, planting, covering, and irrigating by the splash method, the cost comes to $1 to $1·60 per acre. The seed used is either 2 to 3-eyed sets or 2-shoot *rajoengans*. They are spaced about 18 in. apart, centre to centre, the same number of seed pieces being used for every row. Supplies are arranged for, by top seed being placed close together in odd pieces of land at the edge of the field. In the Reynoso system of land preparation, planting cannot take place as early as in the ploughing method, as the soil requires several weeks to become aerated sufficiently for the purpose.

Manuring consists in supplying the canes with nitrogen; less than 10 per cent. of the cane lands have phosphorus applied and practically none potash. The nitrogen is applied in the form of ammonium sulphate, and although the amount varies greatly, it averages about 100 to 120 lbs. of nitrogen per acre. All of this is applied very early, usually immediately before hilling up, either at 3-4 weeks or at 6-8 weeks after planting. Where ploughing is used, the manure is withheld until an even stand is assured, and not as in Hawaii given to induce an even stand. All manure is covered, and is applied in small holes near the plant or in a long furrow near the edge of the trench. The method of application is vividly described by the author; making the holes, bringing the manure, placing the dose in the hole, covering it up—all with "militaristic" precision by separate gangs of women and children, to the sound of the whistle of the *mandoer* (native overseer).

The amount of fertilizer to be applied is determined by experiments planned by the experiment station and carried out by the plantation agriculturist. A vast number of experiments are conducted every year, averaging about one for every 100 bouws, and half of these deal with ammonium sulphate. These experiments suffer the disability that they have to be planned and executed afresh every year, for the cane is always planted on new pieces of land, and anything like cumulative effect is ruled out. The whole scheme has the same precision as the manuring operations, all plots being of equal size, with the same number of lines, equally prepared and handled, and just about enough to fill a car load with the harvest. Needless to say, the carrying out of the experiments falls to the lot of the agriculturist.

The work of gradually filling in the trenches with soil from the ridges has already been referred to. It is done by contract, till the canes at 4-6 months are on the top of a ridge instead of being at the bottom of a trench. This work costs from 40 to 60 cents per acre, the higher figure including the first operations of the Reynoso system. Weeding is done, only in the early stages, by women and children, but the canes grow so fast and close in so quickly that this work is soon over. With the exception of an occasional irrigation, nothing further is needed until the harvest. Several weeks before the harvest a series of ripening experiments is conducted by the agriculturist.

This is all planned out as usual : he obtains the map of the planted area and fixes on the places, usually one per bouw, where the samples are to be collected, and then proceeds to fix numbers to the stools, to be analysed at bi-weekly intervals. Then he calls for all the canes bearing a certain number, cuts them into three parts, top, middle and bottom, puts the whole of the tops from one field together and analyses their juice, treating the middles and bottoms in the same way. After correcting his figures by a factor to bring them into line with the mill results, he compares them with his previous figures, and, when the two lower halves of the canes show no change, he considers the field ready for cutting, and harvesting begins. It will be readily seen of what vast importance the work of the agriculturist is to the plantation.

Harvesting is carried out on similar contract lines, this time with groups of only two or three men, the mandoer marking the rows to be cut each day. An advance is given them at the start which is re-paid at the end of the season. The work, which includes collecting shoots for seed, and keeping the trash out of the inter-courses and drains, costs about 24 cents per ton, and a group may reap 4-5 tons per day. They seldom take their pay till the end of the harvest when they receive a lump sum which they divide equally among them. The author concludes as follows : "The natural conditions for cane culture in Java are extremely favourable, and their garden cultivation is well suited to these conditions. The organization they have built up to handle their industry, both in a scientific and in a practical manner, are excellent, deserve an immense amount of praise, and stand out as shining examples for others to copy." C.A.B.

Mrs. Howard on the Improvement of Plants.[1]

In a former note referring to this paper,[2] only the first part was summarized, and certain hints given by the author, built up on her long experience in India, were thought worthy of being passed on to young plant breeders in the tropics. The second part of the paper, which consists of a historical analysis of the laws governing plant breeding at different times, was left untouched, with the tacit idea of returning to it at a later date.

The subject is of course highly technical ; and any attempt to abstract it without employing the current terminology would be absurd. But as some of the observations are of special interest to sugar cane breeders at the present time, it has been decided to pass on the author's ideas and conclusions in as simple a manner as possible, incidentally demonstrating that the work of the plant breeder is not so easy as may sometimes be supposed by the general public.

The whole of modern plant breeding is based on the work of MENDEL, who published a paper on the results of some years' experiments with sweet peas in the Proceedings of a Natural History Society in 1865. Presumably because of its mathematical tenor, this paper appears to have evoked little interest among the botanists of the Society, and it was lost sight of for many years, until in 1900 it was brought to light again by CORRENS. Then, the moment it was introduced to the notice of plant breeders, its importance was realized, and their work has ever since followed a new path.

1 The improvement of plants. G. L. C. HOWARD. Presidential Address to the Agricultural Section of the Sixteenth Indian Science Congress, Madras. January, 1929. *Agricultural Journal of India*, Vol. xxiv, Part III, May, 1929.

2 *I.S.J.*, 1929, 487.

Before that date, the method generally adopted was that known as selection, and a complicated empirical technique was gradually built up, especially in Germany. The chief problem to be solved was to ensure the stability of the new varieties obtained ; but this was working in the dark, for the laws of inheritance were unknown. And all attempts to formulate these laws seemed only to add to the confusion. The nature and stability of hybrids was specially debatable. The usual view was that a hybrid was a kind of blend between the two parent plants, the complete plant being taken as the unit. But the behaviour of the later generations, and the tendency towards reversions to the parental type were the chief stumbling-blocks. Occasionally, successful plant breeders appeared, who were able, by judgment and long experience, to lay down rules ; but usually their work was concerned with only one crop, and they proved unable to pass on their partly intuitive knowledge. This latter mysterious knowledge the author pithily describes as " an instinct, probably a sub-conscious integration of various small observations."

MENDEL, dissatisfied with the complexity of the plant as unit, hit upon the idea of its being an aggregate of characters, each of which had to be separately studied in breeding work ; characters such as colour of flowers, height of plants, and so on. The re-publication of his work had an instantaneous effect, and the analysis of the plant into separate units of inheritance, and the technique involved, enabled plant breeders to obtain stable varieties within a reasonably short time. From the economic point of view, this was perhaps the greatest benefit which his discovery conferred.

The enthusiasm inspired among plant breeders was immense. Desirable characters could be transmitted unchanged, and combined ; and the regeneration of crops appeared to be a simple matter. It was only necessary to find out two varieties with the desired characters and cross them : the perfect individual could then be obtained in the second generation. The dominance of certain characters, which prevented the reverse characters from appearing although still present but hidden from view, would not be a great difficulty, although entailing some delay. And the greatest scorn was heaped on the old-fashioned workers, who persisted in following the old method of selection—the millenium of crop improvement was in sight.

But, after twenty years of work, plant breeders are sadder and wiser, although monetary gains have undoubtedly been great in places. In India, for instance, where the work has been continued with greater persistence, perhaps, than anywhere else, the gain to the cultivators is estimated at 10½ crores of rupees (nearly £8,000,000). But we are still a long way off from being able to obtain the perfect plant.

Even such characters as the colour of flowers and resistance to disease have turned out to be surprisingly complex. Each one has been found to be dependent on the presence of a number of factors (technically termed *genes*). Taking the apparently simple character of colour in flowers, which has been extensively studied, it has been shown that in Linum (the flax genus) it is dependent on eight factors, producing 32 different forms of colour. This means that, in breeding, the parental form will only re-appear once in a very large number of plants. And, as the perfect plant must possess, united in itself, many desirable characters, each of which may be controlled by the presence of a number of factors, the number of seedlings raised may be so great that, in practice, it never appears. Colour, moreover, cannot always be distinguished by the eye alone ; the red chaff colour in wheat may really be produced by two quite different factors, so that, if crossed, red chaffed wheats may produce white chaffed individuals.

Then what is termed *linkage* further complicates matters. It has been found that certain characters are inherited together. Characters are, for instance, often linked with sex, but linkage may also occur when sex is not involved. But, again, linkage may not be absolute. In certain cases, a percentage of the offspring show that the uniting bond has been broken, and the characters linked in the parent may appear independently of one another in the offspring. This is termed *crossing over*. And, lastly, it has been observed that the factors may not be confined in their influence to definite characters, but influence several organs of the plant : their effect then is manifold. Recent investigations have been able to explain these difficulties in a remarkable manner, but it is quite obvious that such complications as those described make the direct application of the simple Mendelian rules impracticable.

This is a serious set back. It was hoped that, in place of the intuition possessed by the successful plant breeder, MENDEL's law would substitute a series of exact measurements, and thus make plant breeding more or less controllable and mechanical. But this promise has not been fulfilled. The laws of inheritance have proved of more indirect than direct usefulness to the plant improver ; who, however, in the later stages is thrown back on the once despised selection method and his own judgment.

If the constitution of the plant in respect of heredity were once for all determined, there would possibly be a reversal of this need of independent judgment. And some brilliant work has already been accomplished in this direction. MORGAN and his school in America have succeeded in fixing the location of the genes or carriers of inheritance, namely on the *chromosomes*.[1] And MORGAN has not only been able to locate the genes on the chromosomes, but has been able to assign to them definite positions on these. This opens up the possibility of eventually preparing maps of the genetic constitution of economic species of plants, and comparing them with one another. And when such information is available, it may well be that the pendulum will swing in the opposite direction, towards greater precision in practice, and with a new mechanical technique.

The author then proceeds to divide the history of the study of inheritance into three periods as follows : (1) The early period of confusion and controversy, when interminable discussions took place on the many theories propounded by different workers, such as pangenesis, the continuity of germ plasm, the inheritance of acquired characters,[2] and so forth—once looming large in the study of heredity. (2) The period of clarification and definition : clear distinctions were drawn between the different forms of variation, including mutations. The inheritance of acquired characters was negatived, MENDEL's laws were discovered ; and work proceeded, terminating with MORGAN's explanation of linkage and crossing over. Generally speaking, the basal germ plasm of the plant was considered as unalterable, and of absolute importance in inheritance. With each new discovery the subject, although becoming more complicated, became more clear and definite, and the number of fixed tenets or principles became continually larger. (3) The work of the last few years, however, " indicate modifications of our most cherished con-

1 Minute bodies in the cell nuclei, which take an active part in the multiplication of the cell tissues, and are visible, can be counted, and whose numbers are generally found to remain constant in each species of plants. The counting of their chromosomes has already led to important results in the classification of the different types of sugar canes.

2 E.g., such characters as the dwarfing of plants of the plains when translated to high altitudes, or the browning of Europeans after long years in the tropics. These characters, acquired during the life of the parent, were claimed to be passed on in a certain degree to their offspring ; and thus to provide a key to the acclimatization of plants.

victions." At first papers appeared at long intervals, few and far between, but this was followed by a flood of papers describing work and deductions of a revolutionary character, which threw the orderly conclusions of the second period into confusion.

The discussion of only one or two of these latter pieces of work is entered upon by the author, with their implications. The first case shakes the stability of the mathematical basis of MENDEL'S laws. BOND has found that the stage of maturity of the pollen used in crossing has a marked influence on the simple Mendelian ratios holding among the offspring. Thus aged pollen, or pollen taken from plants in a stage of declining activity, gives different results from pollen obtained from normal, actively growing plants or parts of plants. This suggests that the statistical data of MENDEL'S laws may be altered by collecting pollen from different parts of a plant.

The second class of observations suggests that characters acquired by the parents may after all be passed on to the offspring. It was found, both with insects and with plants, that new characters were produced by feeding them with unusual substances; and that these new characters were inherited, at any rate for a number of generations. It certainly reminds one of the inheritance of acquired characters; but in reality illustrates "a new evolutionary principle, that hereditable variations may be induced by means of the food supplied."

Undoubtedly the most important modern researches are those dealing with the origin and nature of mutations. These have long been known, but only recently has it been possible to attempt any real analysis of the various types. The author speaks of two ways in which mutations may arise—by changes in the factors or genes, or in the number or character of the chromosomes. From the theoretical point of view, the former are of greater interest, but their occurrence is rare. Certain investigators have, however, claimed to have greatly increased the rate of mutation, by changes in temperature, radium emanations, and the applications of X-rays. Even then the mutations are small in number. Of undoubtedly greater value in plant breeding are the mutations produced by multiplication or abnormality of chromosomes. And mutations of this type may be also induced by physiological stimuli such as those mentioned above, applied to the sexual cells.[1]

A very large number of papers have been published on this chromosome variation during the last few years, and the author selects one only for mention. MOL has shown that the horticultural practices in Holland, "which have been so successful in producing new bulb varieties, are really methods of producing chromosomal variation. The possibility of inducing changes in the chromosome numbers opens a new chapter in economic plant breeding. The production of chromosomal variation by external stimuli also suggests an explanation of the origin of species, and possibly of acclimatization. It may also furnish the solution of the much discussed problem of change of seed in crops like potatoes."

C.A.B.

METAL CORROSION.—Samples of various metals were attached to the drum of an Oliver filter in a Hawaiian factory, being thus exposed to the action of settlings at 6·8 *pH*.[2] It was found that resistance to corrosion under these conditions (exposure to acid juice and to air) was about the same order as bronze and brass tested the previous season. Alloys of the stainless steel type are more resistant, but "Toncan," "Armco" and ordinary steels are much less resistant.

[1] See *I.S.J.*, 1929, 69. [2] *Report of the Experiment Station*, H.S.P.A., 1929, 29.

The International Society of Sugar Cane Technologists.

History and Organization.

It was a happy idea, fruitful and far reaching in its effects, which prompted the organizers of the Pan-Pacific Food Conservation Conference held in Honolulu during the summer of 1924, to form a cane sugar section, under the leadership of H. P. AGEE, Director of the Experiment Station of the Hawaiian Sugar Planters' Association. It was decided at the outset not to confine participation in the meetings of this section to delegates from the Pacific area, but to embrace all the countries producing sugar cane the world over. The sessions had not very far advanced when the delegates attending, and representing eleven different cane growing regions, resolved to go one step further and to found a permanent organization, to be known as the International Society of Sugar Cane Technologists. It was a small band at the time, but full of vision and enthusiasm. Final plans were soon perfected, and a constitution was adopted on August 12th, 1924. H. P. AGEE was elected President, and H. ATHERTON LEE, Secretary.

The constitution states that the object of the Society shall be to promote, by means of triennial conventions, the discussion of technical problems of the sugar cane industry in both field and factory. Any person who is contributing or has contributed to the progress of the sugar cane industry in any country is eligible for membership in the Society. There are no other qualifications. Nomination and election to membership are covered by a few simple rules. Provision is also made for supporting members, by which is meant those associations, corporations, etc., which send representatives to the Conventions of the Society.

The Society is divided geographically into sections of at least two and not over twenty-five members. Each section is represented on the Executive Committee by a Vice-Chairman. New sections may be formed, with the approval of the Executive Committee.

The policies of the Society are directed by the Executive Committee, which consists of the General Chairman, the General Secretary, the Assistant Secretary, and the Vice-Chairmen of the Sections. The constitution defines the duties of the Executive Committee as a whole and of the various officers, and also the procedure for their election or appointment.

Regular meetings are to be held every three years, and at each such meeting the place for the next one is to be decided by a plurality vote of the members present. Although the constitution makes no specific provision in regard to rotation of meeting places, it has been considered to be advisable, for the convenience of the various sections, to hold the conferences alternately in the Western and in the Eastern hemisphere, and as far as possible North and South of the equator.

Since the Honolulu meeting, two most successful conventions have been held, the second in March, 1927 in Havana, with H. P. AGEE presiding, and the third in Soerabaja, Java, in June, 1929, under the chairmanship of JACOB JESWIET. The proceedings of the first two congresses have been published, and those of the third are about to be issued.

The last two congresses were well attended, each by over sixty delegates in addition to the local members and the guests. About a dozen countries were represented at each and it has been amply proved that international co-operation by local associations is not only most useful, but indeed indispensable for real, substantial progress. The direct personal contact with

fellow members from far-off lands is a delightful experience and productive of much good in fostering understanding and mutual good-will.

SAN JUAN, PORTO RICO, THE NEXT MEETING PLACE.

At the Soerabaja congress invitations for the fourth convention were extended by the delegations from Australia, Louisiana, and Porto Rico, on behalf of their governments or producers' associations. The Society voted to accept the invitation from Porto Rico, at the same time expressing its appreciation of the other two. The next Congress will therefore be held at San Juan, Porto Rico, in 1932. No definite date has been set as yet, but it will be while the grinding season is in full swing, probably in February or March. This is also the best time of the year from the standpoint of climatic conditions. Porto Rico has seen a phenomenal development of its sugar industry during the past ten years, and the trip to the Island will be well worth while from every standpoint. Not only will there be many interesting things to see on the cane plantations and in the sugar factories as well as government institutions established for the benefit of the industry, but the visitors will, like all others that have gone before, be charmed by the beauty of the island and the hospitality of its people.

COMMITTEE WORK.

As a basis for its deliberations, the International Society has adopted a general procedure which has been successfully used by regional associations, that is the system of reports by Standing and Special Committees. Each of the Committees is charged with the study of a specific division or phase of sugar cane technology. These reports are opened for general discussions, and may be amplified by pertinent papers contributed by members of the Society.

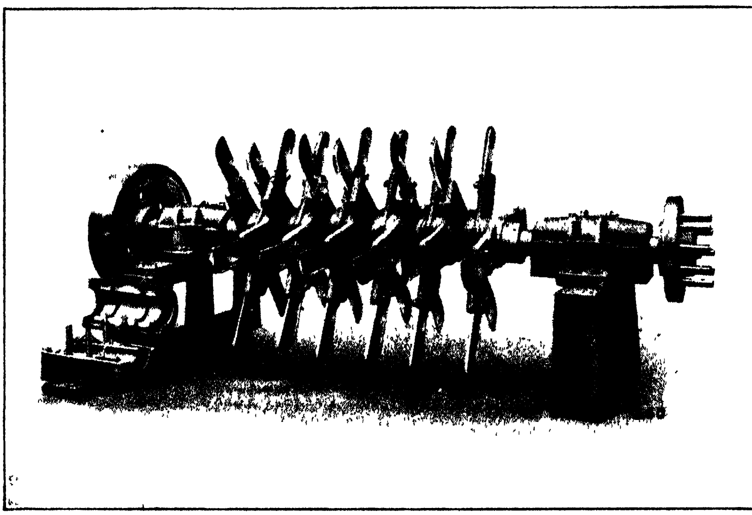
The work of the Society for the present three-year period has been distributed among the following twelve committees which will report their findings at the Congress to be held at San Juan.

(1) The Executive Committee whose duties are prescribed in the constitution, and to which one of the resolutions passed at the Soerabaja Congress has also been referred. It consists at present of the General Chairman, F. W. ZERBAN (U.S.A.); General Secretary, A. H. ROSENFELD (Louisiana); Assistant Secretary, M. A. DEL VALLE (Porto Rico). Vice-Chairmen, W. E. CROSS (Argentine), H. T. EASTERBY (Australia), T. S. VENKATRAMAN (British India), W. SCOTT (British West Indies), T. Y. CHOU (China), E. L. ANDERSON (Columbia), D. L. VAN DINE (Cuba), P. NEUVILLE (Egypt), K. OSHIMA (Formosa and Japan), H. P. AGEE (Hawaii), H. C. PRINSEN GEERLIGS (Holland), P. VIEILLARD (Indo-China), E. C. VON PRITZELWITZ VAN DER HORST (Java), W. L. OWEN (Louisiana), LOUIS BAISSAC (Mauritius), H. H. DODDS (Natal), GERARDO KLINGE (Peru), MANUEL ROXAS (Philippines), M. A. DEL VALLE (Porto Rico), E. W. BRANDES (U.S.A.), and the Directors of the Agricultural Departments or Experiment Stations in Guadeloupe, Réunion, Santo Domingo, and Tahiti.

(2) Committee on Protective Sugar Cane Quarantine: E. W. BRANDES (U.S.A.), Chairman; A. F. BELL, D. S. NORTH (Australia), W. MCRAE (British India), T. MIYAKE (Formosa), O. H. SWEZEY (Hawaii), C. W. EDGERTON (Louisiana), Miss P. C. BOLLE (Java).

(3) Committee on Insect Pests of Sugar Cane: C. E. PEMBERTON (Hawaii), Chairman; T. BAINBRIDGE FLETCHER (British India), F. W. URICH (British West Indies), D. L. VAN DINE (Cuba), MIGAKU ISHIDA (Japan), E. H. HAZELHOFF (Java), T. E. HOLLOWAY (Louisiana), D. D'EMMEREZ DE CHARMOI (Mauritius), G. N. WOLCOTT (U.S.A.).

(4) Committee on Diseases of Sugar Cane: Miss G. WILBRINK (Java), Chairman; A. F. BELL, D. S. NORTH (Australia), H. R. BRITON-JONES (British West Indies), J. A. FARIS (Cuba), J. P. MARTIN (Hawaii), Miss P. C. BOLLE (Java), A. P. D.



McClean (Natal), H. Atherton Lee (Philippines), C. E. Chardon, M. T. Cook (Porto Rico), R. D. Rands (U.S.A.).

(5) Committee on Sugar Cane Varieties : T. S. Venkatraman (British India), Chairman ; E. E. Cheesman (British West Indies), K. Oshima (Formosa), A. J. Mangelsdorf (Hawaii), O. Posthumus (Java), L. Baissac (Mauritius), Th. Braegger R. L. Davis (Porto Rico).

(6) Committee on Cultivation and Field Operations : V. J. Koningsberger (Java), Chairman ; H. W. Kerr (Australia), G. Clarke, Wynne Sayer (British India), J. A. Verret (Hawaii), P. Vieillard (Indo-China), W. G. Taggart (Louisiana), J. Doger de Speville (Mauritius), Manuel Rozas (Philippines), R. Fernandez Garcia, R. A. Veve (Porto Rico).

(7) Committee on Factory Operation and Chemical Control : Noel Deerr (British India), Honorary Chairman ; W. R. McAllep (Hawaii), Chairman ; Norman Bennett (Australia), K. C. Banerji (British India), W. Scott (British West Indies), P. Neuville (Egypt), P. Honig, T. van der Linden, E. C. von Pritzelwitz van der Horst (Java), H. S. Paine (U.S.A.).

(8) Special Committee on Description and Identification of the Original Cane Varieties : W. W. G. Moir (Hawaii), Chairman ; G. Bremer, O. Posthumus, C. L. Ruemke (Java) ; E. Artschwager, H. B. Cowgill (U.S.A.).

(9) Special Committee on Forestry : H. L. Lyon (Hawaii) Chairman ; W. C. Kramer (Porto Rico), D. M. Matthews (U.S.A.).

(10) Special Committee on Uniformity in Reporting Factory Data : F. W. Zerban (U.S.A.), Chairman ; E. C. von Pritzelwitz van der Horst (Java), M. A. del Valle (Porto Rico) ; with sub-committees and individuals co-operating in a number of countries, as shown in special communications of this Committee.

(11) Special Committee on Soils : O. Schreiner (U.S.A.), Chairman ; H. W. Kerr (Australia), F. Hardy (British West Indies), G. R. Stewart (Hawaii), Miss G. Z. Neeb (Java), N. Craig (Mauritius), W. T. McGeorge (U.S.A.).

(12) Special Committee on Technique of Field Experiments : G. Arcenaux (U.S.A.), Chairman ; W. P. Alexander (Cuba), A. J. Mangelsdorf (Hawaii), G. Booberg (Java), Manuel Roxas (Philippines).

Projects initiated by Resolutions passed at the Soerabaja Congress.

The work programme of the Society has been further extended by several of the resolutions which were adopted at the last Congress. The wording of these resolutions and the method of carrying them into effect is given below :

(1) *Irrigation and Drainage.*—" Whereas exact knowledge on the influence of irrigation and drainage is still very incomplete : Resolved that in all cane growing countries more attention should be paid to those problems and that more scientific experiments should be carried out on this subject." This resolution has been referred for action to the Committee on Cultivation and Field Operations, and the Special Committee on Soils has been asked to co-operate.

(2) *Soil Classification and Fertility.*—"Whereas soil surveys and the classification of soils are fundamental for the proper study of soil fertility and manuring for the improvement and maintenance of sugar cane soils : Resolved that the Standing Committee shall (*a*) secure as far as practicable uniformity in the classification and in the nomenclature of soils; (*b*)collect data on soils and fertility experiments on the sugar cane soils of the various countries concerned." The Special Committee on Soils, beng specifically mentioned in the resolution, will carry it into effect.

(3) *Collections of Cane Varieties.*—" Whereas at the present time many identical varieties occur under different names, and also different varieties are cultivated under the same name, and Whereas rational studies on sugar cane require reliable identification and description, and Whereas cane breeding work requires the availability of all original canes and of those canes which have played a part in cane husbandry, and Whereas further investi-

gations on genetics and taxonomy of sugar cane are of prominent importance for further development of the sugar cane industry, Resolved that in two or possibly three different countries collections should be established of all cane varieties mentioned above, and be it further Resolved that the Executive Committee take the necessary steps for the establishment of such collection gardens."

The Executive Committee has already made some progress toward the realization of this project. The principal countries in the Pacific area, especially Hawaii and Java, have not been heard from as yet, but in the West Indian area a tentative plan has been formulated. More will be said about this as soon as the plan assumes definite shape.

(4) *Sugar Cane Quarantine.*—"Whereas it has been demonstrated that there is considerable risk in the unwary introduction of new diseases into any country, and Whereas it is desirable to keep track of the proper nomenclature of all importations and prevent further confusion in names,

"Resolved that new importations be allowed only in small quantities and through recognized institutions, and that steps be taken to record at the time of importation at some central place in the country, preferably under a botanist, full details about the variety such as the name, country of origin, a short description and specimens of canes, buds, and leaves; and whenever possible it is further desirable to keep the cane growing at the central place at least for a time to render its subsequent identification easy and certain, and be it further Resolved that copies of this resolution be sent to all government and other institutions interested in the sugar cane industry, and to the Standing Committee." This resolution has been referred to the Committee on Protective Sugar Cane Quarantine, and its chairman has sent out copies of the resolution as directed in the last paragraph of the resolution.

It will be readily seen that the establishment of variety collections, as called for in resolution No. 3, is dependent on proper quarantine rules. In the countries where comprehensive collections of cane varieties are planned, the quarantine regulations must be such as not to prevent the introduction of varieties needed for the collection, while at the same time protecting the country from the introduction of new diseases.

(5) *New Abstract Journal of Sugar Technology.*—"Whereas the current technical literature on sugar cane and beet is published in a large number of periodicals and often is written in a language which is only understood by a minority of the technologists or is not available in the local libraries, and Whereas further re-enforcement of the interest of organizations and of the personal members of our Society is desired for the further development of the Society, Resolved that a new periodical be started or an existing periodical be requested to publish adequate abstracts in the English language, submitted by the authors themselves of all technical papers of more general importance, and be it further Resolved that a committee be appointed by the chairman to devise ways and means for carrying this resolution into effect."

Accordingly, a committee has been appointed, consisting of H. P. AGEE (Hawaii), Chairman; W. B. SALADIN (Cuba), K. DOUWES DEKKER (Java), A. H. ROSENFELD (Louisiana), R. FERNANDEZ GARCIA (Porto Rico). This committee is doing active work, and concrete proposals have been submitted to it by the member from Java.

(6) *Metric System of Weights and Measures.*—"Whereas at the present time different countries report their field and factory results in many different and unrelated units, thus making mutual comparisons extremely difficult and time consuming, and Whereas the metric system is based entirely on the

decimal system of numbers, relates logically measures of volume to measures of mass, has been legally adopted by most countries, and is in universal use throughout the scientific world, Resolved that the cane sugar industries of the countries represented in this Society be urged gradually to introduce the metric system, and that until this is accomplished, they publish all field and factory results in metric units, either exclusively, or along with the customary units." W. E. CROSS (Argentina), who originally suggested this resolution, has been appointed chairman of a committee, to be chosen by himself, which will undertake the necessary work to make the resolution effective.

(7) *Re-establishment of the International Commission for Uniform Methods of Sugar Analysis.* "Whereas the International Commission for Uniform Methods of Sugar Analysis has not held a meeting since 1912 and has practically disbanded, and Whereas there exists at the present time a great deal of confusion owing to the use of different analytical standards in different countries, Resolved that a committee consisting of F. J. BATES, C. A. BROWNE NOËL DEERR, P. HONIG, and W. R. MCALLEP be appointed, which committee shall approach prominent sugar chemists in all important countries producing sugar from the beet or cane, for the purpose of reviving the International Commission for Uniform Methods of Sugar Analysis."

In spite of the efforts made from various sides during the past ten years, it has so far been found impossible to re-establish the contacts and co-operation which existed before the war through the International Commission. It is to be hoped that the above resolution of the Society will at last bring about the desired result.

The Society thus has placed on its programme a number of problems which urgently require solution, and which can be properly solved only by enthusiastic international co-operation. The importance of this work cannot be over-emphasized. It calls for patient application and serious thought. With the whole-hearted support of the committees and the membership at large, ultimate success will be certain to be achieved.

Formosan Sugar Production.

The Acting British Consul at Tamsui reports to the Department of Overseas Trade that the second official estimate places the production of sugar in Formosa for the coming season at 13,419,935 piculs (about 805,000 tons) of centrifugal and plantation white, and 218,073 piculs (about 13,000 tons) of brown sugar, making the hitherto unattained total of 13,638,008 piculs. This estimate is based on actual results up to the end of October, and the figures show an increase of 482,183 piculs over the record production of the previous season, and an increase of more than one miilion piculs over the first estimate. The improvement in results thus anticipated is ascribed to more advanced methods of cultivation, the planting of better varieties of cane, and favourable weather conditions at the time of planting.

Areas under cane, with estimated production, are given as follows :—

	Area Planted. Acres.	Estimated Production. Piculs.
Centrifugal	227,591	13,419,935
Brown	3,166	115,975
Primitive	6,771	102,098

While the above estimate is authoritative, it is held in some well informed circles, according to press reports, that it errs on the side of optimism, and that the first official estimate is likely to prove the more correct forecast.

Bagasse Filtration in Egypt.

By V. PENIAKOFF, B.Sc.

The device used in two of our sugar centrals in Egypt for the filtration of clear juice from the settlers might be of some interest to readers of the *International Sugar Journal.* The following description refers to Armant S.F. of the "Soc. Gen. des Sucreries et de la Raffinerie d'Egypte." This factory has a daily average crushing capacity of 3000 tons of cane.

The cold mixed juice from the mills is limed with 1500 to 1800 grms. (3·3 to 4 lbs.) of CaO per ton of cane, then treated with sulphurous acid to neutrality (litmus). The juice from the liming tanks is heated to 95°C., boiled in open defecators and let down to the settling tanks. After two hours the clear juice is drawn off, heated to 102°C. (216°F.) and pumped to the clear juice tank. From this tank it flows through bagasse filters which are described further on. The mud from the settlers is filter-pressed as usual, the filtrate being mixed with the clarified juice from the bagasse filters. This mixed juice is then heated to 105°C. (221°F.) and filtered over a second set of bagasse filters. The filtrate is next pumped to the evaporators. Without any further clarification, a single grade of sugar is turned out, averaging 99·50 Pol.

Description of Bagasse Filters.—Each filter is a vertical plate iron cylinder 800 mm. (31·5 in.) in diam. and 3000 mm. (10 ft.) in height. On top and bottom are rivetted cast-iron flanges on which are hinged the top and bottom cast-iron doors. By means of swing bolts these doors can be screwed tight against a rubber gasket inserted in the flange. At the upper part of the body is the juice unit, connected by valve and pipe line to the clear juice tank, and a smaller inlet for compressed air. The juice outlet is in the bottom door and is connected to a canal by a short *S* shaped pipe. The bottom door has a perforated false bottom to prevent the bagasse from choking the juice outlet and to keep the finer particles of bagasse from being carried away with the juice. The bottom door is 2500 mm. (8 ft. 2 in.) above the ground floor, the top one 1,350 mm. (4 ft. 5 in.) above the first floor.

Operation of the Filters.—The filter being empty and the bottom door closed, a disc of cotton filter-press cloth is put over the false bottom and bagasse is thrown in from the top, so as to fill the filter up to the level of the juice inlet. It then contains approximately 230 kgs. (506 lbs.) of bagasse, the lower half of which is taken from the third mill, the upper one from the second mill of a crusher and four mills tandem. The bagasse is covered with another disc of filter-press cloth, the top door closed and the juice admitted progressively. When the rate of filtration falls off, after five or six hours, the juice is shut off and compressed air admitted to drain the filter. The bagasse is then sweetened off with 16 gallons of water and compressed air applied once more. The bottom door is then opened and the bagasse dropped into a truck, whence it is conveyed by an elevator to the carrier between first and second mill to be re-ground.

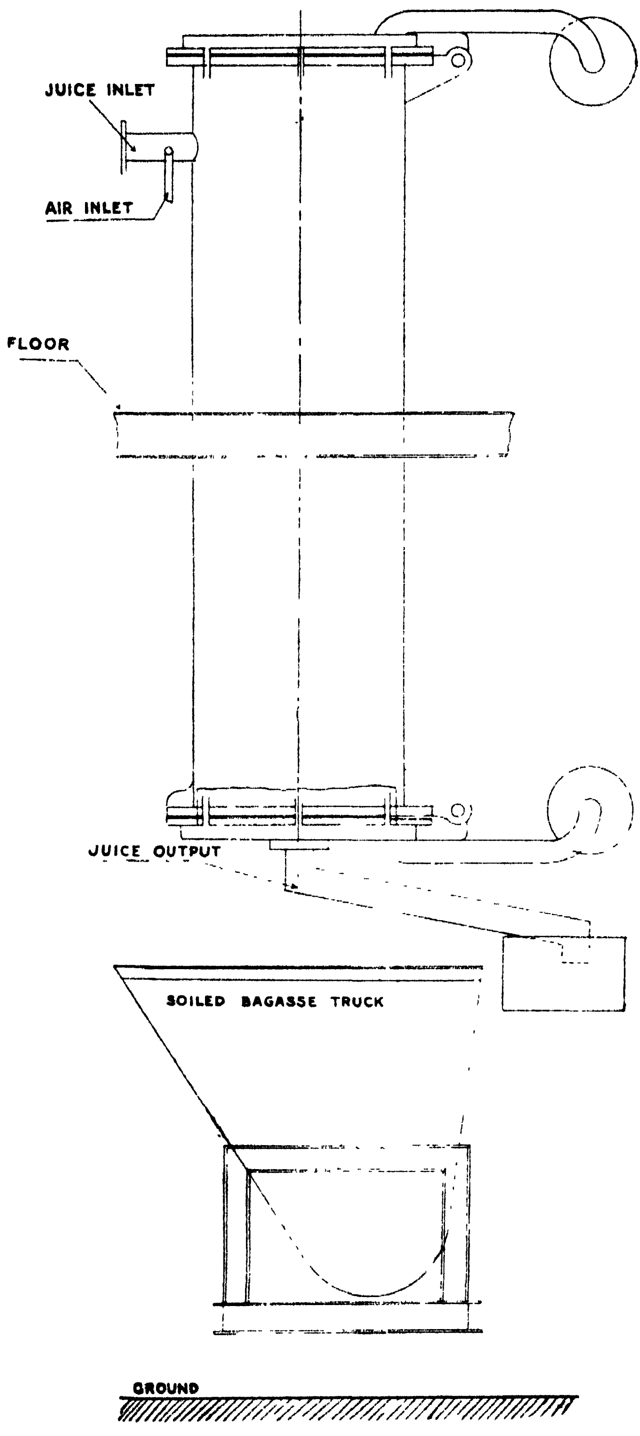
Number of filters used for an average daily grinding rate of 3000 tons cane :—

First filtration :	30	In actual use :	20
Second Filtration :	15	In actual use :	8

Rate of flow of one filter (average of six hours) :—

First filtration :	75 litres per min. (2·6 cub. ft. per min.)
Second filtration :	250 litres per min. (8·8 cub. ft. per min.)

Bagasse Filtration in Egypt.



Average rate of flow per unit horizontal surface of bagasse, through layer of bagasse of 2·400 m. (8 ft.) :—

First filtration :	150 litres per sq. metre per min.	(0·48 cub. ft. per sq. ft. per min.)
Second filtration :	500 litres „ „	(1·64 cub. ft. „)

Head of juice on filter—5 metres (16 ft.)

	Fresh Bagasse	Soiled Bagasse
Water, per cent.....	70 per cent, approx. ..	70 per cent. approx.
Sucrose, per cent. ..	3 per cent, approx. ..	10 per cent. approx.

Bagasse employed : 0·70 per cent. cane.

Juice filtered on 1 ton cane : 117 cub. metres (4150 cub. ft.).

Bagasse filters have been used for several years in our two factories (Armant and Kom Ombo S.F.) that do not work with the diffusion process, and have replaced bag filters used formerly. Several types of apparatus have been experimented with, before adopting that just described. Several advantages have been obtained :—

Low initial cost. The filters have been entirely made in our shops during the off season. Low maintenance cost. Neither cloths nor frames to mend or replace. The labour needed is reduced by two-thirds as compared with the bag-filters, since the handling of the bagasse is all done mechanically. The only labour used is for opening and closing the doors and for pushing the soiled bagasse truck to the elevator. No sugar losses by filter-mud or press cloths. The juice is perfectly clear and brilliant, and no change in the boiling-house work has been observed as compared with the bag filters juice.

No fermentation of the bagasse has been observed in the normal course of work nor even in the event of a stoppage of a few hours. However, if a long accidental stoppage occurs, all the filters have to be emptied and this may cause some inconvenience when work is resumed, as no juice can be filtered so long as a sufficient number of filters have not been filled with bagasse. Also, in the process of emptying the filters when the mills are stopped, some of the bagasse may have to be thrown away.

In spite of its high content in sucrose, the soiled bagasse from the filters does not appreciably affect the sucrose content of the exhausted bagasse of the tandem to which it is returned. Samples of this bagasse taken as it comes out of the last mill have, on the average, the same sucrose content as the normal exhausted bagasse of the tandem.

CUBAN-AMERICAN SUGAR CO.—The report of the Cuban-American Sugar Co. for the year ended September 30th, 1929, states that the raw sugar production was 2,254,584 bags of 320 lb. each, as compared with 1,686,467 bags manufactured during the previous crop. The production of the 1928-29 crop was 2152 bags less than the record output of 1921-22, when 2,256,736 bags were made. Operations resulted in a net profit of $1,204,356 as compared with the corresponding profit for the preceding year of $183,435.

HERISSON CRYSTALLIZERS.—Very favourable results are being obtained with this new type of water-cooled crystallizer,[1] usually eight hours sufficing for first massecuites and 12-14 for low-grades. It has revolving tubes fitted to the shaft, and these give a much more efficient mixing of the massecuite and allow the sugar crystals to make contact with the unexhausted liquor. Due to the high capacity of the apparatus, the factory space which is economized is considerable. This crystallizer has shown an appreciable gain in recovery from massecuite, and it appears to be an invention well worth the attention of those desirous of improving the efficiency of factory work.

[1] *I.S.J.*, 1929, 436, 447, 514.

The World's Sugar Crisis.

A Suggested Economic Step towards its Solution.

A few weeks ago Dr. FRANCIS MAXWELL, the well known author of "Economic Aspects of Cane Sugar Production," contributed to a leading London Sunday newspaper an article outlining the world's sugar crisis and suggesting a technical solution of the difficulty which he claimed would prove economically sound and need not rely for its efficacy on the doubtful degree of international co-operation secured by such agreements as the Paris and Brussels Conferences.[1]

Dr. MAXWELL in the course of his summary of recent sugar history mentioned the League of Nations Report on Sugar, and pointed out that the discussion in that report was based entirely on statistics, and was of a strictly economic nature, neglecting entirely the technology of sugar production. His suggestions on the other hand were based upon an economic consideration of the essential features of the process by which cane sugar is produced and took into account the technical aspect of sugar costs.

The essence of his plan is in effect that when sugar is fetching a price entailing a financial loss in the extraction thereof, this extraction shall not be extended beyong its profit-yielding limit ; that is, the later part of the process should be abandoned altogether, thus leaving an extra per cent. of sugar in the bagasse.

His reasons for this are as follows : In a large modern central, containing one, two, or even three milling trains, each consisting of seven or eight milling units of the largest size, about 95 per cent. of the total sugar contained in the cane is extracted, the rest being lost in the bagasse. Of this 95 per cent. extraction, about 85 per cent. can be obtained by the first three units of the train if properly operated, while it takes all the other units to extract the remaining 10 per cent. The power required to operate a complete milling train of this description is somewhere about 2500 i.h.p. But the important fact ensues that whereas less than 1000 h.p. is needed to extract the first 85 per cent., about 1500 h.p. is required to obtain the additional 10 per cent. Dr. MAXWELL argues that the cost of this 1500 h.p. is an appreciable factor in uneconomic production under present conditions. The paramount question is : A given crop of cane being presented to the factory, can the extraction of such a comparatively small amount of sugar by such a colossal expenditure of power be financially justified, particularly at the present low level of prices. Apparently not, according to Dr. MAXWELL.

Under this scheme of reduced extraction, a large surplus of bagasse not needed for fuel will result, and it is argued that this could be sold at a good price for the manufacture of pulp, building board, or kindred material. Such a saving of fuel is one aspect of the saving of horse-power which is invoked to counterbalance the financial effect of a reduced sugar output.

As for the collective results of carrying out such a scheme, it is pointed out that there are about 50 factories in Cuba having milling trains of seven or eight units each, which in the aggregate would be responsible for approximately 2½ million tons of sugar. Should those large centrals adopt the measure of partial extraction thus advocated, an appreciable restriction of the Cuban crop would result, which Dr. MAXWELL argues would not necessarily entail financial loss. And this measure is not applicable to Cuba alone, for factories elsewhere in the sugar world might sooner or later find it expedient to follow suit.

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1 In that article Dr. MAXWELL expressed the intention to elaborate his argument in a further article contributed to our pages, but owing to his absence abroad he has not as yet found an opportunity to carry out this resolve. We therefore only now give the gist of his original paper.—ED. *I.S.J.*

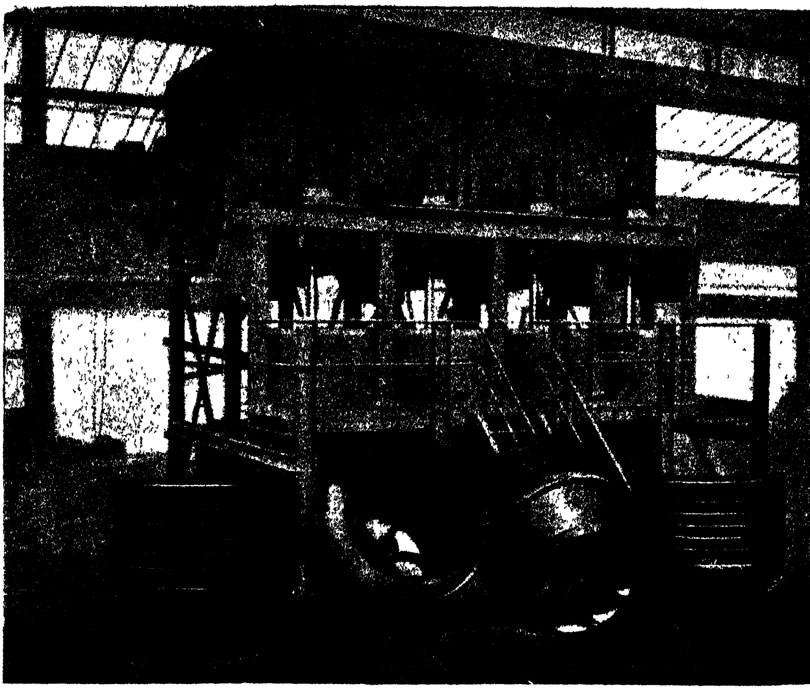
This article in our London contemporary was reproduced in the Amsterdam *Telegraaf*, and was briefly commented on by Dr. H. C. PRINSEN GEERLIGS, who pointed out that the MAXWELL scheme would be profitable only where there existed a market for the spare bagasse. If it could be sold for cash for bagasse boarding, or rayon, or nitro-cellulose, or paper pulp, or if it could find a use for fuel for outside purposes, its outside disposal might well yield a profit. In such a case a calculation will show whether it is better to retain more bagasse and extract less sugar; but if there is no market offering for the surplus bagasse, it will be better to extract as much sugar as is in conformity with the bagasse available for fuel.

It might be useful to have such a calculation set forth, premising that a given market for the bagasse is offering. Dr. MAXWELL singles out Cuba especially as the centre where the scheme might be tried with profit; and it happens, as our readers know, that it is in Cuba that recent experiments in the utilization of bagasse for fibre board manufacture have lately been centred. The latest process, the Vazcane system, which is being tried out, involves a rather drastic re-arrangement of the factory plant; but many factories may prefer to seek a less drastic method of utilizing their surplus bagasse, and may even prefer to sell it as raw material to an outside manufacturer. If they can find the market, then they can afford to economize on their extraction expenses, and the sugar output will be correspondingly reduced.

Java Technical Notes.

DETERMINATION OF THE ACCURACY OF CANE WEIGHING. **J. Radersma.** *Archief*, 1929, **37**, No. 41, 894-908.

Formerly in the determination of the weight of cane for the payment of the cane cutters one was satisfied with an accuracy of ·1 picul (136 lbs.) per lorry or car, that is 1-2 per cent.; but now a precision of half a quintal (say 56 lbs.) representing ½ to 1 Dutch cent in the men's wages is expected. But for determining the weight of cane for the calculation of the cane per hectare, or the sugar per hectare, an accuracy of 2 per cent. is acceptable. Generally, the determination is made by means of a weighing bridge, the gross weight of each lorry being observed as it passes over, and the nett being deducted. Some factories adapt an average tare for all the lorries, which diminishes the accuracy of the result, seeing that lorries of different types are to be found in the yard, and that the weight of one of these may differ from that of another by as much as 3 quintals (about 165 lbs.). Using a bridge with sliding weights on the arm, the sensitivity is such that with a load of 5000 kg. a movement of the arm can be detected with an over-weight of 1 kg. This is a greater sensitivity than is required, but the draw-back of this system is that it demands so much time, each lorry being brought to a standstill for the adjustment of the arm. With the rapid system of weighing, however, in which the weight is read from an indicator, and in which the lorries are moved slowly and continuously over the bridge, though the operation is much more expeditious, it is at the same time less accurate. It is the method used for locomotive traction. Compared with the true value, the weight determined is always higher for the whole of the train, and usually higher for the individual lorries. This error increases with the weight of the train. Long couplings should not be used, and in weighing the train must move as slowly and regularly as possible. Differences in the height of the



buffers should be obviated, and long and heavy trains avoided, 20 lorries being about the limit. Lastly, so as to reduce the resistance of the train, there should be an incline towards the bridge, but not so much as to allow the couplings to sag, a gradient of say 3 to 3½ in a 1000.

EXAMINATION OF JAVA (WHITE) SUGARS OF THE 1928 CAMPAIGN. **P. Honig.** *Archief, deel III, Medeed.*, 1929, No. 19, 1009-1046.

Results of a previous enquiry by the Experiment Station into the composition of different Java sugars led to a negative result.[1] It was not possible to state average analyses for the different grades, so wide were the differences between the results of the various samples of any one grade. Another effort has now been made to do this, using methods of analysis already described,[2] but here only white sugars are discussed, though figures are given in the original paper for superior stroop sugar (av. pol., 98·59), for hoofd sugar (98·44), for muscovado (97), etc. White sugars are classed as good, satisfactory, and unsatisfactory ; and as a general criterion it is assumed that the purest sugar is the best. On the basis of the data collected in 1928, the following is the specification at which it is now possible to arrive :—

	Unsatisfactory.	Satisfactory.	Good.
Polarization	$<$99·20	99·30—99·40	above 99·40
Water	0·08 higher	0·04—0·05	$<$0·04
Reducing Sugars	0·08 ,,	0·040—0·060	$<$0·040
Ash	0·07 ,,	0·030—0·050	$<$0·040
Colour (ε 509mμ)	0·100 ,,	0·030—0·065	$<$0·030
pH	—	$>$6·0	—

In addition to these chemical and physical determinations, sieving tests were made with the following results representing the average :—

		mm.	Per Cent.
Fraction	above	1·65	1·0
,,	between	1·65 and 1·17	7·5
,,	,,	1·17 ,, 0·83	22·9
,,	,,	0·83 ,, 0·59	30·6
,,	,,	0·59 ,, 0·30	33·2
,,	below	0·30	4·7

Commenting on the results for the polarization given above, it is pointed out that the rather marked deviation from 100°V. is caused partly by the temperature at which the readings are made ; partly of course by the water and non-sugar contents ; and partly also by the slight levo-rotation of the reducing sugars. European refined sugars were found under the same analytical conditions as employed not to polarize more than 99·6 to 99·65°. As to water content, some of the white sugars had obviously been insufficiently dried, which is a bad fault from the point of view of keeping well in storage. Sugar having a water content less than 0·03 per cent. will keep practically unchanged under proper warehousing conditions. *pH* values were found to vary more than would be expected, some carbonatation sugars going to 7·7, though sulphitation sugars never went further than 6·9 to 7·0 *pH*. Reasons leading to alkaline sugars are : (1) the use of alkaline steam, traces of ammonia having been detected in some sugars, and (2) the presence in some sugars of relatively large amounts of precipitated lime salts, which dissolve in the solution at about 40°Brix. generally used for the *pH* determination. In determining the colour,[3] at first the extinction was ascertained for five different

[1] *Archief*, 1927, 1108. [2] *Archief*, 1928, 639.
[3] See *Archief*, 1928, 643 for the methods used.

wave-lengths, viz., 435, 509, 546, 578 and 608 $m\mu$, but so regular were the absorption curves that few measurements were found to suffice. In fact, later, the extinction at 609 $m\mu$ was considered to indicate the colour measurement. Examination of white sugars should be completed by observation under a glass ($\times$ 5) to ascertain the regularity of the crystals, and detect the presence of conglomerates and broken crystals.

CHANGES IN THE COMPOSITION OF FILTER-CLOTH WITH USE. **P. Honig.** *Verslagen der Vereeniging van Adviseurs (Java)*, 1929, Afl., No. 4, 158-162.

If used filter-cloth is analysed, certain of its original constituents are found present in greatly increased quantity. It may be that some of the particles of the scums become retained in the pores of the cloth; or it may be the result of the crystallizing of some of the constituents of the juice or syrup on the threads; or, again, it may be a case of adsorption. Whatever may be the explanation filter-cloth after having been in use for some time presents a very different composition compared with what it had before use. Here, for example, is the analysis of filter-cloth which has been in use in a defecation factory, from which will be seen how extraordinarily high are these constituents :—

	Per Cent.
Ash Content	38·37
Wax Content	4·91
Ash Composition :—	
Insoluble in HCl	6·58
$Fe_2O_3 + Al_2O_3$	37·60
Calcium Oxide (CaO)	26·06
Phosphoric Acid, (P_2O_5)	19·58

It is most likely that adsorption plays the principal rôle in accumulating these impurities. Recognizing that this may be so, some time ago filter-cloths were put on the market in America under the trade names of "Metakloth" and "Thoratex," already saturated with certain metallic salts (e.g., those of aluminium), it being claimed that such prepared material suffers very little in use. Another analysis of a cloth, this time used for the filtration of evaporator syrup (sulphited thick-juice in a carbonatation factory) is as follows :—

	Sf. Gemoe Per Cent.
Ash content	36·03
Ash composition :—	
Insoluble in HCl and silica	3·63
Iron Oxide	0·82
Calcium Oxide	29·07
Sulphuric Acid	53·19
Total $CaSO_4$	90·42

In connexion with cloth that has accumulated impurities in this way, one naturally considers the value of washing with weak hydrochloric acid; but this has little effect. A relatively concentrated acid must be used, viz., about 8 per cent. before the absorbed constituents are re-dissolved. But after repeating such acid washing, the mechanical resistance is so diminished that the cloth has to be discarded. Iron salts are known to exert a specific influence on the splitting of filter-cloth, and this is particularly obvious where the fabric comes into contact with a rusty surface. It would seem very probable that oxidation of the cloth occurs, the iron acting catalytically.

MACERATION OF FILTER-CAKE IN DEFECATION FACTORIES. **Ch. J. E. Stok.** *Archief*, 1929, **37**, II, No. 53, 1102-1107.

Although the above-mentioned method of working to recover the sugar remaining behind in the filter-press cake is not at all new, nevertheless it is said to be well worth attention in connexion with the difficulty in sweetening off when dealing with POJ 2878, which contains a higher wax content than the average of the canes formerly ground. Thus last crop at the Pradjekan s.f. since grinding the new cane one had to contend with high filter-cake figures which in spite of efforts could not be reasonably reduced. Therefore the mud maceration system was adopted, when it was found possible to lower the losses to one-third of those obtaining when the ordinary mode of washing was in use. Four of the six KROOG's presses at 56 sq. m. filtering surface were employed to filter the mud in the ordinary way. After steaming out, the cake was dropped into a mixer, diluted to a thin paste with condensed water from the 3rd and 4th bodies of the evaporator, aud filtered through the two "maceration presses." Results for nine weekly periods showing the extent of sweetening off in each are given in the following table :—

Period.	Per Cent. Dry Matter in filter cake.	Polarization filter cake.	Sugar lost per cent. dry matter.	Dilute thin-juice lost per cent. dry matter
1	42·77	7·08	17	144
2	42·69	4·67	11	86
3	42·42	4·51	11	87
4	42·17	3·91	9	74
5	42·34	4·67	4	30
6	42·48	1·46	3	25
7	42·99	1·57	4	26
8	43·28	1·34	3	21
9	42·56	1·19	3	20

No. 1 period represents a week without sweetening-off at all ; 2, 3 and 4 weekly periods of washing in the ordinary way, the average of which is 82 for the dilute thin-juice per cent. dry substance ; and 5 to 9 the maceration system averaging 24, a striking reduction. Other figures are given : for example the weight of filter-cake per cent. cane, which was 2·31 during period 1 ; 2·23 to 2·28 during periods 2 to 4 ; and 1·55 to 1·88 during periods 5 to 9. Wash-water per 100 of cane was 4·1 to 4·7 for periods 2 to 4 ; and 6·5 to 9·0 for periods 5 to 9. Filter-cloth consumption is said not to have risen during the time this maceration method was in use.

RULES FOR BOILER FEED WATER CONTROL. **P. Honig.** *Verslag van de Vereeniging het Proefstation*, 1928, 263-269.

Lately in Java factories serious boiler corrosion has been occurring, the cause of which has not yet been determined ; but in the meantime it is desirable that the following general rules should be followed for avoiding or at least diminishing such unfortunate damage :—First, the feed-water should be held at an alkalinity of 0·01 *N*, that is, so that 100 c.c. of it are neutralized by 5-10 c.c. of deci-normal acid, using p.p. as indicator. Addition of soda should be carried out continuously, the rate of flow being regulated by the alkalinity of the water in the boilers. Caustic soda rather than carbonate should be used. So far as possible, the condensed water should be kept from contact with air ; and, in order further to counteract the effect of oxygen, iron turnings should be placed in the pressure line of the feed pump. Boilers should regularly be blown out ; and a sharp control should be exercised by the chemist as to the sugar and the oil content of the condensed water.

Mr. J. V. N. Dorr.

Mr. John Van Nostrand Dorr, President of the Dorr Company, Engineers, and Chairman of Petree & Dorr, Inc., of New York, has just been awarded the James Douglas Medal of the American Institute of Mining and Metallurgical Engineers "in recognition of his invention of apparatus, and achievement in developing and improving hydro-metallurgical practice." This medal is awarded annually for distinguished service in non-ferrous metallurgy. Mr. Dorr had an early association with industrial research in the laboratory of Thomas A. Edison, and subsequently became engaged in metallurgy, in the course of which he invented and developed that continuous equipment which was the forerunner of the Dorr Clarifier, an apparatus widely used to-day for the clarification of cane and beet sugar juices. Shortly after the introduction by C. G. Petree of his process for the defecation of cane sugar juices without the use of filter-presses, the company of Petree & Dorr, Engineers, was formed to market both this process and the Dorr Clarifier, the use of which latter in the Petree process made continuous automatic operation possible.

J. V. N. Dorr.

In addition, studies of beet sugar carbonatation practice by Mr. Dorr and his associates resulted in a new, automatically controlled method of conducting the first carbonatation step on a continuous basis, known as the Dorr Continuous Carbonatation System. This system is now in use both in the United States and Europe. The development of the equipment early invented by Mr. Dorr and the research necessary to utilize it to the best advantage has led to the building up of an international, industrial organization with branches and affiliations in all parts of the world. The Dorr Company Inc. has associated companies in England, Germany and France, and affiliations in South Africa, Australia and Japan. Petree & Dorr, Inc., has offices in the United States, England, Cuba, Hawaii, Porto Rico and Brazil.

British Beet Production.—According to returns made to the Ministry of Agriculture by the beet sugar factories operating in Great Britain, the total quantities of sugar produced during the two manufacturing campaigns of 1928-29 and 1929-30 to the end of January have been: 1928-29, 194,986 tons; 1929-30, 289,975 tons.

British Guiana's Sugar Industry.—According to a memorandum presented by the British Guiana Sugar Planters' Association to the West Indian Sugar Commission the sugar industry of British Guiana represents a capital of $27,009,608; it offers constant employment to 40,000 persons each year. The casual employees at reaping season would account for a further 10,000 persons. The greatest need of the industry at the moment may be said to be stability and an assured outlook; this is to say, assurance against fiscal changes in the only two markets left to the industry, namely, Canada and the United Kingdom.

Swiss Imports and Production of Sugar.

Imports of sugar into Switzerland have increased considerably since the middle of last century. From 7500 metric tons in 1840, they rose steadily until the eve of the war, when they reached almost 120,000 tons. A set-back was naturally experienced during the war and the subsequent economic crisis, but, on the whole, the development of Swiss imports may be said to reflect fairly accurately the general trend of world production. A certain proportion of the sugar imported into Switzerland is re-exported in the form of condensed milk and chocolate, the quantities involved comprising approximately 40 and 50 per cent. respectively of the total exports of these commodities. These re-exports have fluctuated to a marked extent in the course of years : they ranged from 5700 tons in 1890 to 18,000 tons in 1910, and from 16,200 tons in 1920 to 20,000 tons in 1928.

Inland production consists partly in the refining of imported raw materials and partly in the extraction of sugar from home-grown beet. Imports of raw sugar have not shown very much change in recent years, the highest figure on record since 1922 being that for 1928, with 11,560 tons, and the lowest, that for 1927, with 6360 tons. The only important sugar factory and refinery in Switzerland is that at Aarberg, in the Canton of Berne, the yearly output of which is placed at from 15,500 to 17,000 tons, raw material obtained locally accounting for about 7000 to 10,000 tons of this output. It is computed that inland production represents about one twelfth of local consumption, the balance being covered by imports.

Figures compiled by the Swiss Statistical Board show that several changes have occurred in the demand for the various kinds of sugar. Before the war, loaf and lump sugar commanded a fair market, but both kinds were subsequently almost entirely superseded by crystallized sugar. Thus, in 1913, out of imports totalling 117,300 tons, loaf and lump sugar accounted for no less than 36,070 tons, as compared with only 1680 tons in 1928, with total imports at 143,800 tons. The quantities of sugar which found their way into Switzerland in 1928 were the largest on record, the previous best figure being that for 1914, with 134,500 tons.

The distribution of Swiss imports of sugar according to countries of origin has also undergone modifications. Prior to the war, Austria-Hungary—especially Bohemia—was the principal purveyor to the Swiss market, Germany being a moderately good second. Nowadays, Czecho-Slovakia heads the list of Switzerland's chief sources of supply, providing about two-thirds of Swiss imports, at least so far as crystallized sugar is concerned. Belgium comes next with a share of about one-fifth of these imports. The balance may be traced to France, Java, Holland, Germany and Cuba. The presence in increased quantities of Dutch sugar on the Swiss market during 1927 and 1928 is ascribed to the partial loss of the English market for refined sugar. Since the war, competition between Czech and German refineries has been exceedingly keen in Switzerland, questions of freight rates playing an important part in the matter. In consequence of the reduction of the Czech rates for exported sugar as from October, 1927, German sugar has been partially ousted from the market.

World Overproduction of Commodities.—So many world markets are suffering from overproduction : at no time since the war has the trade in food stuffs been so depressed as it is now, for tea, sugar, coffee, fruits, and in a lesser degree grains are all available in excess. Apart from foodstuffs, surplus stocks are troubling such commodities as rubber, zinc, tin, oil, nitrate and rayon. Regulation of production is urged in all quarters, but the solution of the problem has yet to be found in most instances.

Determination of Sugar in the Beet.

Two Recent Articles Reviewed.

Two articles have recently appeared on the determination of sugar in the beet, both of which deserve careful attention. The first forms part of a report entitled "Some Recent Investigations into Sugar Beet Problems" to the Ministry of Agriculture, and is by G. R. CLARKE, L. F. NEWMAN, and A. W. LING.[1] It deals with : (a) obtaining sample pulp, and (b) estimating sugar content.

SAMPLING AND PREPARATION OF THE PULP.

In the experimental work, 50 beets were taken and a pulp sample removed from each. Three methods are in common use to obtain a fine and representative pulp from the beet, viz., the circular saw ; the conical rasp ; and the "Sans Pareille" press. These three methods were compared. A sample of pulp was obtained from individual beets by the circular saw and by the rasp ; the remainder of the beet was pulped up by means of the "Sans Pareille" press, the sucrose present in each of the three samples being then determined by the Sachs-le-Docte process.

The data indicated that there are slight differences in the sugar content returned from pulp obtained by the three methods, but on the whole the results were concordant and demonstrated clearly that pulp obtained from each of these methods gives practically the same diffusion with water. In routine analysis the press method is too tedious. The rasp gives an excellent pulp, and the proportion removed is a true fraction of the entire root, whereas in the saw method a flat section of definite thickness is removed.

DETERMINING SUGAR BY DIFFERENT METHODS.

Alcoholic Extraction.—This method has been described as the scientific process *par excellence*, and for some time complete reliance has been placed in it. Recent work, however, has shown that errors may easily arise owing to the number of manipulations required, and its use as a routine method is both costly and tedious. There is a possibility of the solution of dextro-rotatory hemi-celluloses ; errors may also arise from the filtering process, differences in temperature volumes, and the difficulties of obtaining a rapid and accurate reading of the rotation in the saccharimeter.

Diffusion Processes.—Three routine processes are in ordinary use, each of which is claimed to be satisfactory, viz., the PELLET hot digestion method ; the KRÜGER cold digestion process ; and the SACHS-LE-DOCTE cold digestion process. For the purpose of comparing these methods, the details of analysis given by BROWNE for each were followed,[2] pulp being obtained by the "Sans Pareille" process, and portions examined by each method in quadruplicate.

The data obtained indicated that with the SACHS-LE-DOCTE cold and the PELLET hot digestion methods comparable sugar percentages are obtained from the same sample of pulp. But the KRÜGER process gives results in which the error between individual samples makes its use in routine practice open to criticism. The SACHS-LE-DOCTE process is more convenient to the routine sugar analyst, owing to its simple manipulative details and the rapidity with which a large number of samples can be examined. In comparing the two methods generally adopted in sugar beet laboratories, i.e.. the SACHS-LE-DOCTE and the KRÜGER processes, the results obtained in this investigation fortify the criticisms raised by LE DOCTE against the KRÜGER

[1] *Journal of the Ministry of Agriculture*, 1930, **36**, No. 11, 1061-1068.
[2] C. A. BROWNE : "Handbook of Sugar Analysis" (Chapman & Hall, London).

process.[1] The SACHS-LE-DOCTE appears to be the more reliable. The alcohol method and the PELLET hot water method have the advantage that it is not necessary to obtain a fine pulp.

CONSTANT WEIGHT AND CONSTANT VOLUME METHODS.

The second article is by E. SAILLARD, chemist to the Syndicate of Sugar Manufacturers of France, Paris, a recognized authority.[2] He comments on methods of determining sugar in the beet, of which he has had long experience, and directs attention to the question of the volume occupied by the mark, a basic point in so-called constant weight methods. In his opinion the most accurate method is a modification of the hot aqueous digestion method.

He first points out that when the constant weight methods were established the typical beet was supposed to have an average mark content of 4·75 per cent., and to contain juice of 1075 density, i.e., 23 c.c. of juice per 26 grms. ; but that at the present time the average beet contains a little more mark, viz., about 5 per cent., making the juice volume 22·75 c.c. A slight correction is therefore here necessary.

This year in France at the end of September beets giving juice at 1120 density, 6·2 per cent. of mark, and 22·5 per cent. of sugar were obtained. One can calculate the error in each of these methods due to the cause indicated. It is 0·02 per cent. with the constant volume method (using a graduated flask) ; 0·12 per cent. with the SACHS-LE-DOCTE ; and 0·24 per cent. with the KAISER-LEWENBERG. In any case the latter method is not to be recommended.

MARK DETERMINATIONS.

J. VONDRAK, of the Sugar Experiment Station, Prague,[3] has pointed out that in the constant weight methods the volume occupied by the mark was established with mark which had been dried in the oven ; and that natural, undried mark occupies a greater volume. But polarization experiments which have been carried out by the present author in the presence of dried and undried mark do not confirm this. The same result was obtained in both series of experiments.

In practising the hot aqueous digestion method using a graduated flask (a constant volume method), as is done at the Experiment Station at Prague, it is difficult to avoid the influence of air bubbles. This mode of operating is defective. It is inadvisable to use fine pulp, as here raspings and cossettes passed through a meat mincing machine are better. Further, if one wishes to eliminate the influence of air bubbles, it is necessary to carry out the digestion in two stages : the first with 160-170 c.c. of liquid in the 200 c.c. flask, which is rotated until the pulp falls to the bottom ; and the second with the volume of liquid almost complete. This is the hot, double aqueous digestion method of the author. Operated in this way in two stages it is the most exact for determining the polarization of beets.

On the other hand the KAISER-LEWENBERG method, using 26 grms. per 100 c.c. of liquid, should be discarded. The SACHS-LE-DOCTE method, using 26 grms. per 200 c.c., is more accurate than the preceding ; but less so than the method using a graduated flask when the beets examined differ from the typical. As it is easily carried out, it is to be recommended in most cases, and especially in routine and selection work.

1 *I.S.J.*, 1927, 214, and 387.
2 *Sucrerie Belge*, 1930, 49, No. 10, 184-188.
3 Congrès de Chimie Industrielle, Brussels, 1926.

EFFECT OF OTHER ROTATORY SUBSTANCES.

Another point arises. In the great majority of cases the CLERGET sucrose agrees almost exactly with the direct polarization. But this is not always the case, even with sound roots, and especially with deteriorated roots. Beets which have developed during a hot and dry summer, as that of 1911, contain more of the dextro-rotatory nitrogenous substances, not precipitable by basic lead acetate. These substances decompose for the greater part gradually during carbonatating, evaporating, and boiling, ammonia being given off. Hence there are undetermined polarization losses during manufacture though not actually any loss of sugar. The same observation applies to the amide compounds which are formed in the silos at the expense of the albuminoid matters. But this is not all. Invert sugar in solution, though levo-rotatory, may give a dextro-rotation in the presence of basic lead acetate, which disappears during liming and carbonatating. Hence another cause of polarization losses.

Past and Present Developments in the Italian Sugar Industry.

By R SANSONE.

The sugar industry, like most other Italian industries, can only exist if strongly supported. For this reason the Government has had repeatedly to introduce special measures to render the working of the industry in all its branches sufficiently attractive as to encourage steady extension. Of late, through these means and by special propaganda amongst the agriculturists, it has been possible to attain quite unhoped-for results, which if further developed will place Italy in time amongst the world suppliers of sugar.

Past Developments.—In Italy the sugar industry began to assume some importance towards the year 1900. The production of sugar, which had been only 63·5 tons in 1881, exceeded 1000 tons in 1891, and reached 5900 tons in 1899, jumping to 23,000 tons in 1900, to 80,000 tons in 1901, and 130,000 tons in 1904. From that year on to 1913 the production fluctuated between 100,000 and 200,000 tons, reaching 300,000 tons in 1914, which was an exceptional year. After this, the production remained for a while close to 150,000 tons per annum, jumping to 200,000 tons in 1922, to 270,000 tons in 1923, 310,000 tons in 1924, 380,000 tons in 1925, and descending to 140,000 tons in 1926, mounting to 280,000 tons in 1927, to 320,000 tons in 1928, and finally reaching 390,000 tons in 1929. Italy has so far always imported a fluctuating quantity of sugar, and in the last year this importation reached 22,000 tons. In 1930 there will be, however, no further need for foreign sugar.

The beets in cultivation occupied an area of 52,000 hectares from 1909 to 1913, attaining to 82,000 hectares in 1922, 90,000 hectares in 1923 and 124,000 hectares in 1924. The abolition in that year of the customs duty on sugar reduced the area under beets to 52,000 hectares, while the re-establishment of a customs duty of 90 gold lire per ton in February, 1925, increased to 180 gold lire in the following October, to 247·50 gold lire in March, 1926, and to 360 gold lire in December, 1928, brought the cultivated area to 79,000 hectares in 1926, to 88,000 hectares in 1927, to 112,000 hectares in 1928, and to 116,111 hectares in 1929, thus demonstrating the industrial advantages to Italy of a Customs protection, which although bearing very heavily on the consumer has greatly benefited the beet cultivator, the sugar producer and the sugar dealer.

Past and Present Developments in the Italian Sugar Industry.

The production of sugar beets has varied in accordance with the area devoted in the different years to their cultivation, passing from 1.800,000 tons in the period 1909-1913 to 2,200,000 tons in 1922, 2,700,000 tons in 1923, 3,700,000 tons in 1924, 1,500,000 tons in 1925, 2.300,000 tons in 1926, 2,000,000 tons in 1927, 2,800,000 tons in 1928 and 3,053,397 tons in 1929. The most important centre for this agriculture has always been the Paduan plain and especially that near the Veneto Emilian regions, which supplies 85 per cent. of the total needs of the industry, the remainder coming principally from Lombardy and Tuscany.

The Sugar Campaign of 1929.—The forty-five usines of northern Italy initiated operations between the 25th of July and 6th of August last and the deliveries were everywhere regular. The beets were generally very rich in sugar, and everywhere were in very good condition and assured an excellent harvest being favoured by suitable climatic conditions. A total of 390,000 tons of sugar is expected, so that with the stocks still in store amounting to 13,500 tons, a total disposable quantity for 1930 of 403,500 tons is assured, against a presumable consumption of 360,000 tons. For this reason all needs may be deemed practically covered.

It is quite improbable that a further increase will follow in the consumption of sugar, owing to the fact that the tax levied on its production, brings about 1,000,000,000 lire (paper) per year (£3,072,135) to the Government, while the protective customs duty represents a sum of 450,000,000 lire (£1,382,488) divided in equal parts between beet cultivators and sugar producers, and there is no chance that either will be moderated in any way so as to cheapen the retail price. For these reasons Italy only consumes about 9 kilos (19·8 lbs.) per year per head, against 40 kilos (88·16 lbs.) consumed in Great Britain, and 55 kilos (121·22 lbs.) in the United States.

For the harvest of 1929 there was in force the same cultivation contract for beets as ruled in the previous year, and had already been in use for some time. Some long and difficult negotiations conducted in December, 1928, resulted, however, in doubling the percentage on the yield of sugar allowed to the beet cultivators, and to the modification of several accessory paragraphs. Hence these secured a better remuneration, representing a by no means inappreciable expense to the industrials. For 1929 the average yield was about 26·5 tons of beets per hectare, a rather low figure, but compensated by the high sugar content reached, averaging 16·7 per cent., against 14 per cent. in 1928 ; a very high figure for Italy, if decidedly below that found abroad.

Recent Industrial Amalgamations.—The Ligure Lombarda Raffinazione Zuccheri of Genoa, and the Gulinelli Company recently took steps to incorporate certain smaller companies. The Ligure Lombarda will absorb the Ravennate and Sarmanto sugar works, with a capital of 2¾ million lire. The capital of the Ligure Lombarda will then be reduced from 85,000,000 lire to 80,000,000 lire. The Gullinelli firm, on its part. will absorb the Lamone Sugar Works (possessing a capital of 6,000.000 lire) and the Liguro Mantovana, (capital 1,000,000 lire), increasing its total capital from 40,000,000 lire to 46,000,000 lire. The above operations complete the programme of the Ligure Lombarda, which aims at achieving the most rational industrial development and the most profitable concentration of the financial assets. The Gullinelli firm becomes responsible for all the industrial activity of the group in respect to the integral working of the establishments ; while the Ligure Lombarda represents the financial side of the combine and will co-ordinate all its operations.

Beet Agricultural Notes.

THE STORAGE OF BEETS.

Investigations were undertaken by G. R. CLARKE, L. F. NEWMAN, and A. W. LING at the request of the Ministry of Agriculture to ascertain the desirability of clamping some part of the crop and so lengthening the factory campaign. Such a procedure if commercially satisfactory would enable the grower to proceed at an earlier date with winter cultivations, the beets being removed from the ground when at their maximum sugar content.

Methods employed.—Six lots, each of 50 beets, were selected as in the previous year and placed in similar clamps of the type used for mangolds, but each set of 50 beets was enclosed in a loosely woven net, instead of in bags. This was to ensure free circulation of air throughout the length of the clamp. The clamps were 10 yards long, and the nets were distributed evenly along the entire length, so that each sample was separated by more than a yard from its neighbours.

Laboratory procedure was practically identical at all centres, and each sample was subjected to the following determinations : (1) Loss of weight of the entire sample during storage. (2) Dry matter content of the pulp. (3) Percentage of sugar (sucrose determined by the SACHS-LE-DOCTE method with frequent checking by other standard methods, e.g., precipitation of copper and alcohol extraction).

Conclusions.—A considerable number of results were tabulated. In considering these it must be borne in mind the season 1927-28 was an abnormal one. This was reflected in the keeping qualities of the beet. The data obtained at all three centres indicate that, under adverse climatic conditions, beets, when stored either in clamps or under covered sheds, lose both moisture and total dry matter, and that beets crowned before storage may seriously deteriorate. This latter condition is mainly due to fungi which attack the beets on the cut surface left by crowning. It also appears probable that a greater loss is sustained by secondary growth in imperfectly cut or in uncrowned beets. Either or both of these factors may cause a diminution of the commercial sugar yield.

The results obtained in the season 1928-29, however, tend to show how much climatic changes affect the condition of beets during storage. In contra-distinction to the abnormality of the season 1927-28, the year 1928-29 appears more representative of normal English weather. The loss sustained by beets stored under the conditions obtaining during the second season may be considered as very small ; but experimental evidence is lacking as to the physical characteristics and disease-resisting powers of beets grown under varying climatic and edaphic conditions. There seems reason to suppose that, if economic considerations allow, and if the season is as favourable as 1928-29, beets can be stored in clamps without serious loss to the grower.

MANURING PROBLEMS.

At a meeting of about 60 Notts and Leicestershire farmers, brought about by the Ministry of Agriculture and the Anglo-Scottish Beet Sugar Corporation, Ltd., fields at Saxondale and Shelford were inspected. At the former place half the crop had been dressed with sulphate of ammonia, and the rest with nitrate of soda ; whilst at the latter farmyard manure had been used. Markedly better results had been obtained with nitrate of soda than with sulphate of ammonia. Mr. R. N. DOWLING (County Agricultural Adviser) emphasized that while varying conditions of weather and other conditions made comparisons between manures difficult, a top dressing with a fair amount of nitrogenous manure before drilling was very advisable. For one

thing it reduced the percentage of "bolters." The same speaker discussed briefly insects attacking the beet, these including the wireworm, the "springtail," the mangold beetle, and the cutworm. The springtail was a particularly bad pest, he said, but the cutworm was the beet grower's worst enemy, and was often present without the farmer knowing it.

Capt. R. B. TROLLOPE (Agriculturist, Anglo-Scottish Beet Sugar Corporation, Ltd.) made some remarks on the question of liming the soil. This had been gone into as carefully as possible during the last two years, and it would astound many people to learn that the result showed 90 per cent. of arable land to be acid. Beet would not thrive on acid soil, and extensive experiments with lime had been made in consequence. Land must be tested, for unless the lime quantity was corrected 50 per cent. of the amount expended would not be returned. It was futile to put on one ton of lime if there was a three ton shortage in the soil. To this end tests and advice were constantly made and given by both the Ministry and the factory. Lump lime allowed to slake in the field lost half its value, nor should lime be applied with yard manure, because the ammonia would be lost. Lime harrowed in, and the land then left for spring work, was the correct procedure. During the last 12 months 9,000 tons of factory lime had been sent out. They had no definite results upon which to base definite rules in this country yet. They would have to go on working for another ten or twenty years before they could safeguard themselves and made definite statements as to what should and what ought not to be done.

MISCELLANEOUS.

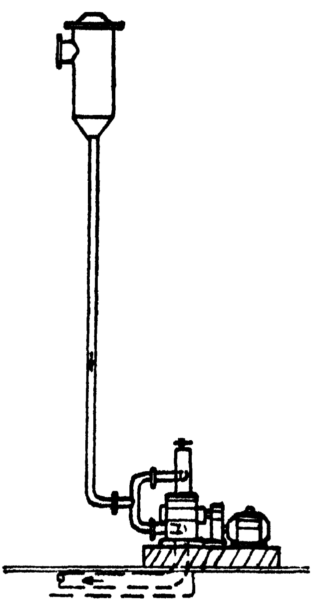
Beet Diseases.—G. VERPLANCKE, who is Assistant at the Phytopathological Station of Gembloux, Belgium, has published an excellent short article on the diseases of sugar beet which are due to filtrable viruses.[1] Three are described : (*a*) Curly Top ; (*b*) Mosaic ; and (*c*) Yellowing. In regard to Curly Top, this is provoked by the insect *Eutettix tenella* Baker in America, and elsewhere, but this insect does not appear to exist in Belgium. In the case of Mosaic, the carrier is *Myzus persicae* ; but in that of Yellowing the means of dissemination does not appear to have been traced. In each of the three diseases, it has been possible to infect healthy plants by inoculation with juice from infected plants. *Scums as Fertilizer.*—Carbonatation scums from the beet factory really form a useful fertilizer in correcting acidity and improving the texture of the soil ; but less use is made of it than should be, owing to the fact that this by-product is generally difficult if not impossible of application, being a pasty mass. A patent was recently taken out in France by the Sucrerie de Bolbec-Nointot with the object of remedying this defect, the invention consisting in incorporating the scums with powdered limestone or chalk, or with calcium sulphate (gypsum), either in the proportion of about 20 per cent. A dry material capable of being conveniently transported, or of being easily sprinkled over the field is thus obtained. Fertilizer constituents containing potash, nitrogen or phosphoric acid may be added to make its effect more complete.

CATERPILLAR TRACTOR CO.—The annual report of the Caterpillar Tractor Co. for the year 1929 shows that the total earnings were over thirteen million dollars, as compared with 9½ millions in 1928, an increase of over 40 per cent. The total net sales came to nearly 52 million dollars, as against 35 millions in 1928, or an increase of 48 per cent. With increased production there have been numerous price reductions in the company's lines of tractors, which are roughly speaking about one-third cheaper than was the case five years ago.

[1] *Sucr. Belge*, 1929, 49, No. 7, 121-127.

Beet Factory Technical Notes.

Cheap Current.—The efforts which are being made to lower the cost of production in chemical works by abolishing all possible waste and utilizing every possible by-product are being directed in Germany to consider the latent energy in water falling through pipes from a height. Condensers, coolers, and dephlegmators are here principally concerned, points out HANS WOLLENBERG, an electrical engineer, who writes on this subject. Hitherto[1] the waste water from such plant has been conducted into the river, the reservoir, or the drain without thought of utilizing the energy at the outlet of the fall pipes containing it. Calculate, however, the value of the power thus lost, he remarks, and the result will be surprising. For example, if one assumes that from a condenser having a fall pipe of 10 metres (32 ft.) the amount of water is about 4·2 litres (nearly 1 gallon) per second, then at the base one has : $\frac{4{\cdot}2 \times 10}{75} = 0{\cdot}56$ H.P. And if a turbine be used for converting this power into mechanical energy, one can realize at its axle an efficiency of 70-75 per cent., equivalent to 0·4 H.P. This machine can be used for running a small dynamo, which will give 0·18 K.W. at 230 volts, sufficient for the lighting of a small workshop. Actually of course in a factory where there are several such sources of power the fall-pipes will be directed to one large turbo-dynamo, and valuable energy which otherwise might be wasted can thus be utilized to some advantage.



Silicious Evaporator Scale.—O. SPENGLER and the late C. BRENDEL, of the Institute of Sugar Industry, Berlin,[2] publish some useful data on silicic acid as a component of beet factory evaporator scale. A greater or less amount of silicic acid, or silica (SiO_2) is always present ; but it is seldom stated by the chemist whether the sample he has analysed was taken before or after the apparatus had been cleaned with hydrochloric acid. Silicic acid may of course have been deposited from the juice as such, but it may also originally have been present in the scale as calcium silicate, which, on treatment with HCl would decompose to silicic acid and soluble calcium chloride. In the beet factory silicic acid is more likely to be deposited as such than as calcium silicate, which latter probably would be decomposed in the presence of the sodium carbonate of the natural alkalinity of the juice. A recent analysis[3] shows as much as 33·7 per cent. of SiO_2, most of which must have been present in the uncombined state ; and it is further shown that it is mostly in the last vessel of the evaporator that silica accumulates, from which it follows that it is precipitated mostly above a certain density. Incrustations containing silicic acid, which have a density of 0·34 to 1·30, lower the heat transmission far more than do those consisting mainly of calcium carbonate and sulphate, the density of which is high, generally 2·4 to 2·60. Silicic acid is most likely to originate from the limestone, the coke, the walls of the kiln, and to a less

[1] *Chemiker Zeitung*, 1930, 54, No. 1, 9.
[2] *Zeitsch. Ver. deut. Zuckerind.*, 1929, 821-830.
[3] *Deut. Zuckerind.*, 1929, 548.

extent from the dirt adhering to the roots. That it is introduced rather with the lime than otherwise is proved by some laboratory experiments of the authors, in which the course of SiO_2 (determined by means of WINKLER's sensitive molybdate method[1]) was followed through carbonatation. Evidence was adduced showing that the silicic acid passing into the clarified juice does not come so much from the raw juice, or the water used in diffusion, as from the lime used for the defecation. Some becomes precipitated during the first carbonatation, and more yet during the second, but some escapes and passes into the clarified juice. It is clear, therefore, that to obtain a clarified juice low in silicic acid, and thus to assist in reducing scaling in the evaporators, it is necessary to use lime as low in this constituent as possible.

pH and Inversion.—R. J. BROWN, of the Research Laboratory of the G. W. Sugar Co. of Denver, Colo., says[2]:—"Previous to the adoption of *pH* control, juices were normally kept alkaline to phenolphthalein, probably at 8 *pH* or above. Following the adoption of 7 *pH* as standard, capacities increased, sugar quality improved and extraction improved decidedly. One curious fact was that at times rather large quantities of invert sugar appeared in the molasses, and molasses free from invert sugar almost never was produced. An investigation taught: (1) sugar solutions invert slowly at 8 *pH*, and the rate increases as the *pH* is lowered; (2) invert sugar is destroyed by heat and by the impurities present in beet syrups. According to the theory of inversion, sugar should invert at any *pH*, since inversion is caused by hydrogen ions and all sugar solutions have hydrogen ions present. *pH* is only a measure of the number of hydrogen ions present in a solution. We call 7 *pH* neutral because pure water, which contains an equal number of hydrogen (*H*) ions and hydroxyl (*OH*) ions, contains the number of *H* ions represented by 7 *pH*, at room temperature. If we heat the water to boiling, the number of both kinds of ions increases and about 6 *pH* represents neutrality. Therefore 7 *pH* has no great significance. At *pH*'s below 7 the inversion rate is found to be proportional to the number of hydrogen ions present, and since there is nothing magical about 7 *pH*, there is no obvious reason why *H* ions should not have the same power above 7 as below 7 *pH*. Actually we have found that sugar does invert above 7 *pH*, and when pure sugar solutions are tested invert sugar may be found in solutions heated above 7 *pH*. It is not generally found in factory syrups since the impurities may destroy the invert sugar as fast as it is formed. We have examined syrups containing invert sugar, which after heating at 8 *pH*, contained no invert sugar although sugar was actually inverted during the heating. The rate of destruction of invert sugar was great enough to destroy all the invert sugar originally present, as well as the freshly formed invert. Thus the invert sugar content of an impure syrup is no measure of the amount of sugar which has been inverted. The invert sugar which is found in molasses is just the difference between the amount of invert sugar formed and the amount of invert sugar destroyed."

Milestones of the G.W.S. Co.—The Great Western Sugar Company, of Denver, Colo., started with six factories in 1905, and to-day operates 21, and the daily output of sugar has increased from 60 to 600 tons. They now supply 40 per cent. of the beet sugar produced in the U.S. A few milestones in operating progress are here pointed out by R. J. DEVENISH.[3] Firstly, it is mentioned that considerable attention has been given to getting rid of trash

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1 *Zeitsch. Angew. Chem.*, 1914, **27**, I, 511.
2 *Sugar Press*, 1929, **13**, No. 11, 14-15.
3 *Sugar Press*, 1929, **13**, No. 12, 10-12.

and stones. Spiked board floaters in the flume were first used to catch trash, and the operation of these was made easier by the MOONEY crane. The first DALTON was a wheel tried at Fort Collins, later improved to the present familiar type. At Fort Morgan, FRANKLIN, an old mining man, suggested the pulsating stone catcher, which has proved successful. The roller picking table, used successfully in Michigan for several years, was in 1917 placed in Bayard between elevator and washer, not to remove trash, but because of flat slope. Its efficiency as a trash remover was demonstrated and it is now standard equipment. The capacity of all factories has been enormously increased, largely by the introduction of chains in the battery. By experiments at Gering it was proved that most of the loss of head in the battery was caused by piping and fixtures, but so far little has been made of this information and the batteries are essentially the same as they were in 1905. Capacity has also been increased in the last few years by cutting square instead of V-shaped cossettes. Squares were anathema five years ago. Pulp was handled by troublesome drags instead of pumps as now. Carbonatation presses have been gradually developed. First KROOG plate-and-frame, then KELLY, and now rotary, with the introduction of the absolutely new feature of thickeners. The first DECLUY baffles were installed about 1911 and now reduce entrainment in the evaporators of all factories, except Lovell. The GRAHAM continuous sulphitors were unknown in 1905. Seeding of pans became common practice perhaps ten years ago. Belt-driven centrifugals took the place of water-driven machines more than twenty years ago, and in time these will be superseded by electrical drive, with the motor acting as generator when baskets are at rest. In the boiler-houses automatic stokers feed fuel of uniform size, with resulting economy and with elimination of smoke. Ashes are now carried hydraulically from boiler-house to dump. Plunger pumps have largely been replaced by centrifugals. Individual motors have taken the place of long lines of shafting. In the STEFFEN houses refrigerators were long ago scrapped. The hot saccharate process has been developed, and the research laboratory cooler placed in new houses. Chemical control has reached a high stage and, with the co-ordination between factories rendered possible by travelling technical men, has been the most important cause of efficient operation. In this work the research laboratory has been essential. "Looking forward we can see continued progress in size and efficiency. Before 1955 we can expect to see greater economy of fuel and labour. Perhaps we may see continuous batteries, possibly of the OLIER type, at work, perhaps LAFEUILLE crystallizers, possibly scientifically controlled granulators as urged by the research laboratory and certainly mechanical means of moving sacked sugar into cars. Refined sugar may be stored in bulk and shipped in bulk, too, in tank cars to customers using large quantities."

MISCELLANEOUS.

Effluent Purification.—Experiments which were commenced in 1927 by the Department of Scientific and Industrial Research[1] on the purification of the waste waters from beet sugar factories by the process of biological oxidation on percolating filters, were continued during the 1928-29 sugar-beet campaign. The investigation has included experiments in the laboratory and on a semi-commercial scale. During the 1927-28 campaign, under the conditions employed, a purification of 70 to 80 per cent. was obtained, and this was improved to 90 per cent. purification in the semi-commercial scale experi-

[1] Report for 1928-29 of the D.S.I.R. (H.M. Stationery Office, 3s. 6d. nett).

ments carried out in the following year. This amount of purification was obtained when treating pulp-press liquor diluted with flume water. Before admixture with pulp-press liquor, the flume water had been subjected to partial settlement but it still contained suspended matter which was largely deposited in the filters. The filters showed signs of "ponding" at the end of the 1928-29 campaign, which lasted only sixty-nine days. With a longer campaign it is probable that the deposition of solid matter in the filters would have been sufficient to put them out of action. In view of the promising results which have been obtained, the investigation will be continued during the 1929-30 campaign with the object of ascertaining what further improvement in the process can be made. *Polish Results.*—Average results of the working of 30 Polish beet factories were recently published,[1] from which the following figures are extracted : Sugar content of the roots, 17·2 to 19·08 per cent. ; juice draw-off per 100 kg. of roots sliced, 106 to 126 litres ; lime per 100 kg. of roots, 1·8 to 3·0 kg. ; sugar per cent. scums of the first carbonatation, 0·85 to 2·05 per cent. ; sugar in the second carbonatation scums, 0·22 to 3·05 per cent. ; coke consumed per kg. of roots, 0·45 to 1·26 kg. ; coal per 100 kg. of roots, 11 to 15 kg. (raw sugar is made). *Beet Fat.*—It is known that sugar beet contains up to 0·2 per cent. of fatty substances, which for its extraction, points out P. Pavlas,[2] requires that the dried, powdered slices should be treated, first with ether, and following that with alcohol. During the course of manufacture, half this fat remains in the exhausted slices, pressing of which reduces the amount to one-tenth. Beet fat contains about 40 per cent. of unsaponifiable matter, from which sterol can be separated by solution in alcohol. *Reducing Sugars Determination.*—It is known that in the determination of reducing sugars by means of Fehling's solution certain non-sugar substances exert an effect on the accuracy of the result. Marie Herlesova[3] points out that the result is lowered by the presence of a small amount of ammonium sulphate. Much greater errors, however, are caused by the presence of certain amines, or amino-acids, in the assay liquid. Glutamin and asparagin, which occur naturally in beet molasses and other beet factory products, were found to have quite a marked effect in lowering the result. In a series of experiments it was found that the presence of 5 mgrms. of purine bases, such as occur in beet molasses, produces marked errors, making the results about 25 per cent. lower than the truth.

Sodium Flame.—Pencils prepared in accordance with the formula devised by T. McLachlan and A. W. Middleton,[4] for providing a sodium flame capable of giving a sharp reading with coloured solutions in polarimetric determinations, are now obtainable from London laboratory suppliers. The end of the 6 in. pencil is inserted in an ordinary Bunsen flame, which method of providing a sodium light flame entirely obviates the trouble experienced in the usual method of heating a piece of common salt.

City Guilds Examinations.—Certificates of the City and Guilds of London Institute Examinations in Sugar Manufacture are more and more regarded as useful qualifications for the sugar chemist and engineer. There has been keen competition for the medals (Bronze in Grade I and Silver in the Final Examination) which are offered to candidates obtaining the highest number of marks in the examinations. In South Africa, the local entries this year total 38, being 24 for Grade I. and 14 for the Final Examination. There are also a good number of entries anticipated from Mauritius, the West Indies, and Australia. Particulars are obtainable from : The Superintendent, City and Guilds of London Institute, South Kensington, London, S.W.7., or from local educational authorities.

[1] *Gazette Sucriere Polonaise*, 1930, No. 8 ; through *Suppl. Circ. hebd.*, No. 2133 of 1930.
[2] *Zeitsch. Zuckerind. Czechoslov.*, 1929, 54, No. 2, 9-23.
[3] *Zeitsch. Zuckerind. Czechoslov.*, 1929, 44, No. 1, 1-5.
[4] *Analyst*, 1927, 639.

Publications Received.

Heat Transfer and Crystallization. Prof. W. L. Badger. Article VII[1]; Principles of Forced Circulation Evaporation. (Swenson Evaporator Co., of Harvey, Ill., U.S.A.). 1930.

Increases in the viscosity of the evaporating liquid increase the thickness of the stagnant film and decreases the convection currents. If heavy liquids could during evaporation be kept constantly in circulation, it should be possible to obtain rates of heat transmission many times higher than possible by natural convection. Mechanically operated propellers have disadvantages, the principal being a high power consumption. Recently, however, a system of positive circulation has been experimentally installed by the Swenson Evaporator Co., at the University of Michigan, this acting on the principle of withdrawing liquid from the cone of a vertical tube evaporator and pumping it back into a upper auxiliary cone so as to give a positive discharge over the tubes. A large number of experiments have been run with this forced circulation evaporator, the results of which are promised later.

Theory and Practice in the Use of Fertilizers. Firman E. Bear, Ph.D. The Wiley Agricultural Series. (Chapman & Hall, Ltd., London.). 1929. Price: 20s.

This is a skilful summary of the various points of view regarding fertilizer theory and practice that have been developed by the many workers in this field since the time of LAWES and GILBERT of Rothamsted fame on to the present day. In the main it treats of the subject historically, and photographs of the famous men who have built up the science from LIEBIG onwards, together with extracts from some of their papers, suggest the personal treatment. There are chapters on the nitrogen controversy, the biological fixation of nitrogen, on nitrification, and the nitrogen economy in soils; then on the mineral theory, the ash analyses of plants, and the mineral constituents of the soil solution. A sketch of the development of the fertilizer industry follows. After this are chapters on the different fertilizers, nitrogenous, phosphoric, potash, and mixtures of these; and here one learns how low-grade mixtures are being eliminated in favour of concentrated fertilizers saving transport charges. Remaining chapters set forth typical fertilizer practice with the selection and application of fertilizers. There is a chapter on the control of the soil reaction. Lastly is given one on the organic matter of the soil, in which the importance of processes of making artificial manure as developed at Rothamsted is a feature. Throughout the book is found a considerable amount of information on fertilizers of a practical nature presented interestingly.

Photosynthesis. H. A. Spoehr. American Chemical Society; Monograph Series. (The Chemical Catalogue Company, Inc., New York.) Price: $6·50.

In this book are set forth the theories and experimental evidence relating to the manner in which the green plant plays a rôle of a converter of radiant energy. A voluminous literature on the subject has collected since the first definite observation of value from the chemical view-point was made by PRIESTLEY, viz., that plants are capable of forming oxygen. Yet in spite of the very considerable amount of work done much remains obscure. Part of this book is devoted to describing the schemes and theories that have been proposed to explain the various chemical steps in the conversion of CO_2 to starch and sugars. LIEBIG's theory that organic acids are intermediate products in the synthesis has received support from different biochemists from time to time, having in fact re-appeared periodically with modifications. In BAEYER's theory, which has received attention perhaps more than any other, synthesis takes place by way of CO_2, carbon monoxide and formaldehyde. Much work has been done on the possible way in which formaldehyde is condensed to sugars in the plant, and to date it must be admitted that its mechanism has not satisfactorily been determined. This book renders service in stating the present position of photosynthesis, a difficult and complex subject.

[1] See also *I.S.J.*, 1929, 670.

Brevities.

STARCH IN CANE.—The Experiment Station, Hawaii, confirms Haddon's observation[1] that starch accumulations are to be found in Natal Uba cane when grown on an acid soil, whereas in the mature parts of Hawaiian Uba, P.R. Uba and POJ 36 starch was absent. In H 109, D 1135 and UD 1 starch accumulations of another type were found, these occurring only above the nodes and only in the first two or three layers of parenchyma cells surrounding the bundles. They are being investigated further.

SUPERPHOSPHATE BAGS.—At present there is considerable wastage due to the impossibility of using jute super-phosphate bags more than once, as these when emptied soon rot. Tests have indicated, however,[3] that a simple and effective remedy consists in shaking the bags free from super-phosphate dust as completely as possible then immersing them in a weak alkaline bath (10 lbs. of soda crystals or 4 lbs. of soda ash in 50 gallons of water). Then the bags are fit for use again, it is said, and are practically immune from acidic decay.

ELECTROMETRIC *pH*.—In Hawaii equipment for making *pH* determinations with the quinhydrone electrode, suitable for routine work in factory laboratories, is being distributed.[4] This method of *pH* determination is recommended by the Experiment Station as preferable to the colorimetric, being stated to be more sensitive and accurate, and as colour does not interfere this method of H.I.C. control can be extended to include all the products in the latter part of the process. Colour charts, says the Station Chemist, will still be useful, but he adds that now it is advisable to use the quinhydrone electrode for control purposes.

SENA SUGAR ESTATES.—According to the *African World*, the sugar output from the Sena Sugar Estates' four factories on the Zambezi has exceeded all expectations this year with a total production of 70,000 tons from 277,000 tons of cane. These figures include the production from the Mopea and Luabo estates in the Quelimane District of the Colony as well as from the Caia and Marromeu estates, which are within the territory administered by the Companhia de Moçambique. The Sena Sugar Estates have made a contract with a Durban syndicate for the sale of the whole of their molasses, which is being sent from Chinde to Durban in a specially built tanker carrying 1100 tons. The yearly output of this molasses is estimated at 23,000 to 25,000 tons.

TRADE IN CUBA.—A D.O.T. Report on Cuba remarks that during the years of high sugar prices the mills made extensive additions to their machinery, with the result that they now have machinery capable of grinding nearly twice the quantity of cane they are receiving. The general concensus of opinion in the sugar industry in Cuba to-day is that this country must rely on her ability to produce sugar at as low a cost as it can be produced anywhere in the world, giving special attention to improved methods of cane cultivation. Very few sales of sugar mill equipment are reported so far by the local mill supply houses. Amongst the large sugar-mill groups under American control there is an increasing tendency to place all orders of any magnitude through their buying offices in the United States, buying locally only what they find themselves in urgent need of during the grinding season.

IMPERIAL SOIL BUREAU.—Sir John Russell, D.Sc., F.R.S., Director, Rothamsted Experimental Station, points out in a recent article[5] that "it is palpably impossible for the agricultural expert busy with his own problems to read all this enormous mass of literature in so many different tongues. It is equally impossible for him to leave it alone." Under Sir John's directorship, therefore the Imperial Soil Bureau has been formed. Its main duties are to maintain an index of the researches being carried out in different parts of the Empire, and as far as possible in foreign countries; and to distribute information about soils (and fertilizers) to officials in all parts of the Empire. Memoranda are being drawn up dealing with mechanical analysis and analytical processes, soil erosion, green manuring, field experiments, etc. A soil map of the Empire is contemplated, and enquiries from soil experts are answered. Generally the Bureau will endeavour to assist all engaged in studying the soils and growth of crops in the British Empire.

1 *I.S.J.*, 1928, 442, 446. 2 Report of the Experiment Station, H.S.P.A., 1929.
3 From evidence given recently before the Australian Commonwealth Tariff Board.
4 *Report of the Experiment Station*, H.S.P.A., 1929, 95.
5 *Journal of the Ministry of Agriculture*, 1930, 36, No. 10, 925-928.

WHITE BEET SUGARS.—At a meeting of the Swedish Chemical Society recently, S. Reuterskiöld emphasized the difference between some beet white sugars and bone-char refined sugars.[1] Some of the former, he said, are capable of masking flavours in preserve making, as could be shown by the following test : Some water was slightly flavoured with essence of ginger. In 100 c.c. of this water 3 grms. of the beet white sugar were dissolved, when it was noticed that the aroma had disappeared. On the other hand, on dissolving 3 grms. of refined sugar in 100 c.c. of the same ginger-flavoured water, the aroma still persisted.

H-ION CONCENTRATION.—" Colorimetric indicators previously used for such measurements are based upon empyrical laws.[2] The fundamental condition in which we are interested in such measurements is the concentration of the hydrogen-ions, and as we have rather definite information about the electrical charges carried by hydrogen ions the most direct method for measuring hydrogen-ion concentration is that of measuring the electric potential set up by the presence of the hydrogen-ions at a hydrogen electrode . . . . . *The accepted method for measuring hydrogen-ion concentration is the electrical method, all colour indicators being calibrated against electrical measurements.*"

ALCOHOL DEHYDRATION.—In the recent article published in these columns on the production of absolute (water-free) alcohol,[3] mention was made of the old lime process. This method of extracting the last few per cent. of water remaining in the alcohol after rectification is actually still in use, though very uneconomical, due to the large loss incurred. It is now reported[4] that at Kehl, Germany, where this method of dehydration is carried out under pressure, a very serious explosion occurred resulting in the death of two of the plant engineers. It seems surprising that such a process, both dangerous and primitive, should still be in use in Germany and elsewhere, seeing that modern methods of dehydration, which give a good recovery and work economically without being at all dangerous, are in use in different countries.

RAT CONTROL.—Continuing experiments in the Pathology Department of the Hawaiian Sugar Planters' Association, J. P. Martin reports[5] on the relative toxicity of rat poison baits. Captive rats, it was noticed, refused to eat barium cakes unless deprived of other food. Although many rats died from strychnine poisoning, many could eat apparently unlimited amounts of wheat treated with this poison. A more attractive bait was found in the form of wheat treated with thallium sulphate, which has now been generally adopted along Hawaiian plantations as a cheap satisfactory rat bait. It has no bad taste, and its ready ingestion is favoured by the rodents. Almost complete cessation of subsequent rat damage has been determined when thallium torpedoes have been thoroughly distributed in the rat-infested areas. Such bait, however, requires to be handled with care, and skin absorption by man is avoided by the use of rubber gloves when the salt is in aqueous solution.

" LIQUID SUGAR."—In the U.S.A. liquid sugar is being offered to makers of confectionery, preserves, canned goods, bread, soft drinks, ice creams, and the like. It is sold in three forms, viz. :—(*a*) a standard sucrose solution (colourless) of 67·6° Brix. (36·9°Bé.) ; (*b*) sucrose solution No. 2 (slight amber cast) of the same density and (*c*) invert sugar syrup of 76·5° Brix (41·5°Bé). It is distributed to the buyer in metal drums of 55 gallons, in tank trucks of 1200-1500 gallons, or in tank cars of 8000 gallons. A storage installation is required by the user, consisting of an enamel-lined storage tank situated at a suitable height for gravity feed and a centrifugal pump for raising the syrup from drum, truck or car to storage tank. The price of the syrups is based on the current market price of fine granulated sugar, and on the densities stated above, less an allowance. Thus the price of the standard syrup No. 1 is the basis price of granulated sugar minus $0·30 per 100 lbs. of solids. In the case of the No. 2 syrup the deduction is $0·35 per 100 lbs. of solids. Invert syrup is priced on a somewhat similar basis. Economy is claimed thus to be realized, the cost of crystallization and bag packing of ordinary sugar being said to be distinctly less generally than the extra freight and handling charges for the liquid sugar.

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1 *Centr. Zuckerind.*, 1929, 37, No. 49, 377.
2 Extracted from a paper by I. MELVILLE STEIN on " Precision Industrial Records and Controllers " ; *Journal of the Franklin Institute*, 1930, 209, No. 2, 201-228.
3 *I.S.J.*, 1930, 77. 4 *Zeitsch. für Spiritusindustrie*, January 23rd, 1930.
5 Report of the Experiment Station, H.S.P.A., 1929.

Review of Current Technical Literature.[1]

Ash and Electrical Conductivity of Cane Syrups and Molasses.[2] F. W. Zerban and Louis Sattler.[3] *Ind. Eng. Chem.* (Analytical Edition), 1930, 2, No. 1, 32-35.

A rapid and accurate conductometric method for the determination of ash in raw cane sugars was described in a previous paper.[4] The percentage of ash (sulphated, less 10 per cent.) is :— 0·0001757 (9·13K + 1935 — K_1), where K is the specific conductance × 10^6 of the sugar solution itself, and K_1 is that of the solution acidified with HCl. This is the "conductometric formula." The investigation is now extended to syrups and molasses, the range of the ash content of which is roughly 10 times that of raw cane sugars. In dealing with raw cane sugars, 5 grms. of sample were dissolved in 100 ml., but now to avoid the depressing effect of the non-sugar non-electrolytes contained in syrups and molasses one-tenth of the quantity of material was used, viz., 0·5 per 100 ml. In order further to make up the non-electrolyte concentration in such solutions, 4·5 grms. of sucrose was added to the 0·5 grm. of sample, thus imitating the composition of a raw sugar, the exact experimental procedure being as follows : 25 grms. of syrup or molasses was dissolved in 100 ml. of hot conductivity water, filtered by suction through a mat of filter pulp covered with asbestos into a 200 ml. flask, the mat washed repeatedly with water, and filtrate and washings after mixing made up to the 200 ml. mark at 20°C. Two 20 ml. portions of the solution were evaporated on the w.b., in silica dishes to a thick syrup, and sulphated ash determinations made on them. For the conductivity measurements, 20 ml. was diluted to 500 ml., and to another 20 ml. portion was added 22·5 grms. of refined tablet sugar in a 500 ml. flask, the final volumes being completed at 20°C. Conductances were measured as usual with and without addition of 5 ml. of 0·25 N HCl to 200 ml. of the solutions. Detailed results have been assembled in a series of tables, mimeographed copies of which can be obtained from the authors. These figures show the average and maximum errors compared with the chemical ash method, being for the C-ratio method with addition of sucrose ± 0·184 and ± 0·84 per cent. respectively, and for the conductometric formula method ± 0·121 and ± 0·47 per cent. Anyway now the C-ratios are of no great significance, being greatly influenced by the anions present, as even in the absence of sucrose the conductometric formula method generally gives better results. The agreement is not so good for the cane syrups, for which the slightly modified formula should be used : 0·001757 (9·13K + 1976 — K_1). In refinery syrups bonechar treatment causes a profound change in tho character of the product, depending on the amount of char used, due probably to the change in the relative proportions of the cations in the salts present. Instead of the factor 0·001757 in the conductometric formula, therefore, one lower is required, as is shown in the following table, giving the appropriate factors for different products with and without sucrose addition :—

Products	Factor — With Sucrose		Factor — Without Sucrose
Raw sugar factory :—			
Cuban blackstraps	0·001757	..	0·001640
Porto Rican blackstraps	0·001757	..	0·001640
Intermediate molasses	0·001757	..	0·001640
Cane syrups	0·001757[a]	..	0·001640[a]
Refinery :—			
Filtered syrups	0·001647	..	0·001551
Unfiltered syrups	·0001662	..	0·001566
Final syrups (refinery X)	0·001731	..	0·001622
Final syrups (refinery Y)	0·001700	..	0·001590
Final syrups (miscellaneous)	0·001710	..	0·001596

a See above for modified formula.

It would appear from this work that even with the conductometric formula method it would be necessary for each refinery to determine appropriate factors for

1 This Review is copyright, and no part of it may be reproduced without permission.—Editors, *I.S.J.* 2 See *I.S.J.*, 1929, 324, for a short abstract of this paper.
3 Chief Chemist and Assistant, New York Sugar Trade Laboratory. 4 *I.S.J.*, 1928, 31.

each class of material. If the cause of the variations in the factor of the correction formula can be discovered, it may be possible to de 'elop a more general formula applying to all products of the raw sugar factory as well as those of the refinery.

SUCROSE LOSSES IN CRYSTALLIZERS DURING COOLING. **F. H. King and E. B. Jamora.** *Sugar News*, 1930, 11, No. 1, 19-27.

Previous work by investigators has shown that the decomposition of pure sucrose in solution is a function of the temperature and the time. Deterioration due to contamination by micro-organisms, and inversion due to the hydrogen-ion-concentration, may also be factors. No information is available in the literature as to the extent and causes of the possible losses of sucrose during crystallization, excepting perhaps a paper by SALINAS in Cuba,[1] who concluded that crystallizers were "glucose formers." Therefore, with the object of getting further information on what appears to be an important matter, the authors studied the behaviour of sugar for varying periods of time in 12 crystallizers of the Calamba sugar estate, P.I. Determinations of gravity solids, sucrose, and reducing sugars were carried out according to standard methods, whilst for the *pH* a quinhydrone electrode was used. Following are the results of the chemical tests made :—

Crystallizer Number	Hours in Crystallizer	Temperature °C.	Sucrose / 100 Brix.	Glucose / 100 Brix.	Sucrose loss	Glucose gain or loss	*pH* decrease
	0	76·0	62·69	14·05	1·63	+·48	0·24
1	192	42·0	61·06	14·53			
	0	72·0	64·41	12·84	2·31	+·66	0·22
2	192	40·5	62·10	13·50			
	0	72·0	62·38	14·21	1·34	+·53	0·17
3	48	54·0	61·04	13·68			
	0	78·0	60·00	14·12	2·19	—·92	0·29
4	72	48·5	57·81	13·20			
	0	76·5	62·69	14·37	1·09	+·03	0·29
5	96	47·0	61·60	14·40			
	0	76·0	61·48	15·25	1·66	—·76	0·27
6	96	48·0	59·82	14·49			
	0	74·5	62·06	12·90	1·31	+·04	0·37
7	48	54·0	60·75	13·03			
	0	72·0	61·37	13·74	1·62	—·21	0·31
8	42	57·5	59·75	13·53			
	0	71·0	61·38	15·29	0·88	—·18	0·05
9	24	51·5	60·50	15·11			
	0	79·5	60·12	15·34	1·11	—·14	0·24
10	38	55·0	59·01	15·20			
	0	71·0	59·88	15·63	0·23	+·92	0·06
11	24	55·5	59·63	16·55			
	0	75·0	59·45	15·22	0·74	+·52	0·08
12	24	54·0	58·71	15·74			

It is clear from these figures that sucrose was lost during the period of crystallization, the average of the 12 tests giving 2·93 per cent. Assuming that 23·7 per cent. of the 12 per cent. of sucrose in the cane is treated in the crystallizers, this loss will amount in a mill grinding 1000 tons per day to about 0·833 tons of sugar. It is also seen that sugar decomposition was greatest when the temperature initially was high, and when this temperature was maintained fairly high during the preliminary period of cooling. It is also controlled by the purity. Consideration of the *pH* data indicates that acids were rapidly formed during the period when the massecuite was maintained at its highest temperature. Determinations made of the micro-organisms present during the sojourn of the massecuite in the crystallizers showed that there was practically no increase in their number, so that the sugar losses indicated are not considered to be due to contamination either by yeasts or bacteria.

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[1] *I.S.J.*, 1929, 147.

UTILIZATION OF DISTILLERY BY-PRODUCTS (CO_2 AND VINASSE). **E. Humboldt.** *Facts about Sugar*, 1930, 25, No. 1, 18-19.

Utilization of the by-products of a distillery using molasses is simple in theory, but in practice it presents difficulties of a physical or mechanical kind. The amount of CO_2 evolved during the process is slightly over 97 per cent. of the weight of the alcohol produced, and it is possible to recover about 75 per cent., or approximately 5 lbs. per gallon of absolute alcohol produced. The compression plant is not expensive, but the cylinders used in storing and handling the product represent a heavy item; the cost of a 50 lb. cylinder varies from $15 to $17 and a good many of them are immobilized for several weeks, since they must remain in the custody of the purchaser till empty. A plant packing 10 tons daily, or 400 50 lb. cylinders, must have a stock of approximately 3000 to 4000 cylinders, representing an investment of $50,000 to $60,000. Carbonic acid from fermentation always has a definite odour, more or less objectionable, which must be removed if the product is to be used in the manufacture of beverages or of dry ice. Other impurities are small amounts of alcohol, aldehydes, esters, and fusel oil, all of which are easily removed. But the odour, which is due to mere traces of butyric and valeric acid, is very persistent; oxidation fails to destroy these compounds and they must be absorbed either by activated charcoal or by a solvent, such as glycerin, or a neutral paraffin oil. The last named product is by far the most satisfactory as it also absorbs the last traces of fusel oil; it can be regenerated very easily by heating. The purification is best done by scrubbing with water and finally by a weak solution of soda ash. The scrubbing must be slow and progressive. All entrained water is best removed after the first compression stage, or at least after the second; if a strictly dry gas is desired, the product can be passed through calcium chloride in its way to the last compression stage. The process thus presents no difficulty whatever if common sense and good engineering are used throughout; with proper design the use of chemicals is unnecessary.

In modern distillery practice the yeast is not separated but is run right through the beer still with the fermented mash. Experience has shown that fermenter yeast is very hard to separate as such, on account of its colloidal nature, resulting from the presence of cells of all sizes and stages of growth. The " slop " itself, whether free from yeast or mixed with it, contains some calcium, sodium, and potassium salts, a large amount of carbohydrate of various kinds, and some proteins. In all cases it must be concentrated to 36-40° Bé. before being subjected to the final treatment. The old tunnel evaporators, in which the direct heat of some fuel is used, are cheap but dirty and wasteful. Also, the agitators wear out quickly. By far the best way is to evaporate in a multiple effect, which should have copper calandrias, or at least copper tubes and tube sheets.

Ordinary vacuum evaporation is far from satisfactory on account of heavy incrustation. It is much simpler to use a triple effect working at 45-48 lbs. pressure in the first body, the last one being the heater of the beer still. Such an installation, properly designed, will deposit most of the incrustating material away from the heating surface and will be much cheaper in operation and in steam consumption than an ordinary vacuum triple effect. Properly conducted, a good triple effect will easily concentrate the still output to 36-40° Bé., and at that concentration it will burn without outside heat. In some plants it is customary to simply spray the concentrated liquid on a brisk fire in a furnace with a good draught. As soon as the furnace is heated throughout, no other fuel is necessary. Care must be taken to remove the clinker before the combustion is complete, else it will fuse together and may slag down the brick wall. Most of the ash obtained in that manner carries from 35 to 45 per cent. of potassium oxide, and is sold as such to fertilizer manufacturers. It would be far more advantageous to separate and refine the potassium compounds in a fair state of purity, when they command a much higher price.

Besides the mineral matter, the concentrated slop contains large amounts of carbohydrates and proteins and by destructive distillation in closed vessels it is possible to recover a large quantity of acetic acid, methanol, acetone, and acetone oils. There is a very good market for the various products thus obtained. The process of destructive distillation, however, is not as simple in practice as it looks in theory.

The mass first loses its water, then enters a state of semi-fusion, and finally becomes solid and very hard immediately before the period of carbonization. But to completely carbonize a mass of 2 ft. thickness will demand a temperature of about 800°C., or a bright red for several hours, to the end that the centre may reach about 275-290°C. Of course, such heat is very destructive to the material in use; besides, it means an enormous waste of fuel. Considerable time and money were spent during the war in experimental work in a large plant turning out about 22,000 gallons of alcohol daily and the problem was finally solved to the satisfaction of all concerned. The permanent gases are best burnt under the retorts, to avoid any offensive odour. As for the tars, they can either be distilled by various tar oils or burnt under the retorts after a washing. When the operation has been properly conducted in good equipment, including a well designed tar scrubber, washing is hardly necessary, as all but the last traces of acetic acid have been removed. Jointly with the various aliphatic derivatives, there is produced a large amount of ammonia, which can easily be recovered and which is well worth recovering. As for the leached out charcoal, it is in a fine powdered condition and dries quickly when extracted from a hot water wash. Concentrated slop behaves a good deal like wood, and its carbohydrates present the same phenomenon of exothermic decomposition at about 275°C.; consequently, in well designed equipment the amount of auxiliary heat needed is quite small. To sum up, a plant designed and built to operate as a single unit from the initial molasses to the production of alcohol and CO_2 and down to the continuous evaporation of the vinasse and its destructive distillation will yield the best returns in valuable by-products at a minimum cost. And, which is far more important, such a plant can be made clean and attractive, free from noxious odours and from the filthy messes which are so frequently found around distilleries.

PHILLIPP CRYSTALLIZING PROCESS. *Deut. Zuckerind.*, 1929, 54, No. 41, 1095-1096. Consists in adding a stream of water continuously to the massecuite while crystallizing, and is in effect a method of obtaining a constant degree of supersaturation throughout crystallization. Massecuite is boiled as closely as possible, and when after about an hour's mixing in the crystallizer it has reached supersaturation one runs in water at such a rate that the supersaturation is maintained, cooling and crystallization taking place evenly. A first-product requires about 350-400 litres of water per 700 zentners (70 metric tons) of massecuite, and for a mixing duration of 8-9 hours the rate of addition is ¾ litre per min., thus a very small amount. This process is said to have been taken up in 30 factories employing 250 crystallizing plants.—VAPOUR PRESSURES OF SATURATED SOLUTIONS OF LACTOSE, SUCROSE, GLUCOSE, AND GALACTOSE. **E. O. Whittier and S. P. Gould.** *Ind. & Eng. Chem.*, 1930, 22, No. 1, 77-78. The vapour pressures of saturated equilibrated solutions of sucrose, glucose, galactose, and lactose have been determined at 25°C. These values indicate that the hygroscopic tendencies of these sugars differ, decreasing in the order listed. Calculated values have been obtained for the percentage of atmospheric humidity with which each saturated sugar solution would be in vapour pressure equilibrium. It is suggested that lactose might possibly be substituted in part for sucrose or glucose in confectioners' products in which the hygroscopic tendencies of these sugars are objectionable.—VISCOSITY OF BEET HOUSE SYRUPS. **A. N. Bennett and A. R. Nees.** *Ind. & Eng. Chem.*, 1930, 22, No. 1, 91-96. Design and use of a falling sphere viscometer is described. Results are recorded of its application to beet house products; as solutions of sucrose and raffinose; Steffenized and un-Steffenized syrups; and syrups from the barium process of recovery.—FORMATION OF PECTIN JELLIES BY SUGAR. **G. Spencer.** *Journal of Physical Chemistry*, December, 1929. "Within the jelly field for every fruit is a sugar-acid concentration, which will yield a jelly of whatever characteristic desired. This may be arrived at with some precision by the use of commercial pectin and formulae based upon a knowledge of the characteristics of each specific fruit. Hitting upon it by the evaporation method is a matter of "luck." Failure to set means that the sugar-acid concentrations are outside the jelly field for that fruit. These must be moved into the jelly field, or the jelly field must be enlarged until the original acid-

sugar concentrations are included within it. This is obviously done by adding more pectin. It could also be done by adding to the juice certain salts or other substances which tend to stabilize the pectin."—ARTIFICIAL MANURE FROM STRAW ("ADCO"). **R. C. Collison and H. J. Conn.** *N. Y. State Agric. Expt. Station, Bulletin No.* 573 *of* 1919. A heap of mixed oat and wheat straw was impregnated with a mixture of salts in the following proportions per ton of dry straw: ammonium sulphate, 60 lbs.; ground limestone, 50 lbs.; superphosphate, 30lbs.; and potassium chloride, 25 lbs.; and the stack allowed to ferment with periodical additions of water. A second heap was built under parallel conditions, using "Adco," as developed by RICHARDS and HUTCHINSON.[1] In three to four months both piles had rotted completely and resembled decomposed farmyard manure; and both gave satisfactory results when applied in vegetative tests.—PRODUCTION OF GLYCERIN FROM BEET MOLASSES. **P. V. Golovin.** *Zhur. Sakharnoi Prom.*, **1**, 22-25. Equal volumes of beet molasses and water are boiled for 1 hour with turf powder, diluted to 1074-1091 and fermented after having added ammonium salts, phosphates, calcium, manganese and sodium hydrogen sulphite for 36-48 hours. After distilling to remove the alcohol and aldehyde, the sulphite is recovered with lime and the solution filtered and neutralized, the glycerin being finally steam distilled.—SUGAR BEET AS SOURCE OF PECTIN. **A. J. Codling and H. E. Woodman.** *Jl. Agric. Science.*, 1929, **19**, 701-714. According to the authors, beet pulp pectin cannot impart a jelly condition to acid sugar syrups, and has therefore no technical significance. This inability to gel is connected neither with the mineral impurities nor with changes in the pulp pectose during the drying of the material in the factory.—H.I.C. OF REFINERY LIQUORS. **W. R. McAllep.** *Report, Experiment Station, H.S.P.A.*, 1929, 90-91. Considerable preliminary work was required before sufficiently reliable *pH* determinations were obtained with these dense but lightly buffered liquors. The hydrogen electrode could not be used, even when voltages were determined by the ballistic method, for no practicable method was found for attaining a satisfactory equilibrium in the hydrogen-saturated solution. Consistent results were finally secured with colorimetric methods after the necessary precautions with respect to the quality of the water, proper neutralization of the indicators, and the technique for making comparisons had been defined. Satisfactory results were also secured with the quinhydrone electrode after observing the necessary precautions.—COLLOID MEASUREMENTS OF CANE SUGAR. **W. R. McAllep.** *Ibid.*, 1929, 92-95. Cataphoresis measurements on numerous samples of Hawaiian raw sugars were made, but little evidence of correlation could be detected between filtration rates and dye values of individual samples. Ultra-filtration through a nitro-cellulose membrane in a specially designed apparatus seems a much more promising method of studying filtration characteristics. Permeability can be varied, and it is a reasonably satisfactory laboratory procedure. The amount of non-dialysable matter (material retained on the membrane) was very useful in work at Wailuku, and if further work gives as consistent results as have been secured up to the present time, ultra-filtration will be very useful in studying the filtration characteristics of raw cane sugars.—HEAT INSULATING MATERIALS. *Technical News Bulletin* (Bureau of Standards, Washington, D.C., U.S.A.) No. 153. A study of the insulating properties of jute, cotton, flax, wood fibre, bagasse, corn stalk fibres, moss, excelsior, wood shavings, etc., was made. There is practically no choice between the different commercial grades of these materials. The waste or poorest grades, therefore, may be commercially available for the manufacture of heat insulating materials. Tests made of each fibre, packed to different densities, showed that each fibre has an optimum density at which the thermal conductivity is a minimum or the insulating value a maximum. Tests have also been made on mixtures of different fibres. It has been found that the addition of relatively small quantities of good insulating materials to large quantities of comparatively poor material may yield a product of surprisingly good insulation value.—ASH DETERMINATION OF BEET RAW SUGARS BY THE ELECTRICAL METHOD. **O. Spengler and F. Tödt.** *Zeitsch. Ver. deut. Zuckerind.*, 1930, **80**, 1-10. During last campaign in Germany 108 raw beet sugars were examined at the Institute for Sugar Industry in Berlin by the conductivity method, using solutions of (*a*)

[1] *I.S.J.*, 1924, 226, 615.

5 grms. of the raw sugar in 100 c.c. of water; (*b*) 28 grms. in 100 c.c.; and (*c*) 5 grms. with 25 c.c. of N/40 HCl in 100 c.c. of water (as proposed by ZERBAN and SATTLER)[1], the results obtained being compared with the percentages of ash by the usual incineration process. So small on the whole were the differences between the two methods that it was impossible to decide to which should be given the preference on the point of accuracy. In general, the conductivity results agreed between themselves better, this being probably explained by the fact that a larger sample is taken for the determination. Insoluble ash is of course included in the result for the incineration method, but this does not wholly account for the somewhat higher result; as after the deduction of the percentage of insoluble ash, the incineration figure is generally a little higher than that found by the conductivity method. The authors intend to suggest that the conductivity method be put on the programme of the next International Commission for the Uniform Methods of Sugar Analysis, so that data on its general value may be brought forward.—SAVING FUEL IN CANE FACTORIES. *Aust. Sugar J.*, 1929, **21**, No. 5, 321. With the object of reducing the bill for extra fuel, tests were made in one of the Queensland sugar mills, using certain control apparatus, as steam flow meters, flue gas analysers, and also thermometers and draft gauges. As the result of only one week's observations, it was found possible by proper regulation of the conditions of combustion to reduce the fuel bill by 25 per cent. The flow meters determined the quantity of steam flowing along any pipe, or the amount of feed-water going into the boiler. The gas analysers determined the CO_2 and CO, and in conjunction with data on the furnace temperature and draught in the flues made it possible to determine the proper conditions for combustion.—DETERMINATION OF SULPHUROUS ACID IN FOODS. **S. Rothenfusser.** *Zeitsch. Unters. Lebensm.*, 1929, **58**, 98-109. About 20 grms. of the sample are mixed with 250-300 c.c. of water in a 500 c.c. flask, some fine pumice added, and the flask attached to a condenser; 5-10 c.c. of 25 per cent. phosphoric acid are added through a tap funnel, and the liquid distilled into a mixture of 5 c.c. of 5 per cent. benzidine in 90 per cent. alcohol, 5 c.c. of 30 per cent. acetic acid, and 5 c.c. of 3 per cent. hydrogen peroxide, using an adapter terminating in a bulk with a small opening, and reaching to the bottom of the receiver. About 60 c.c. should be distilled over; any benzidine sulphate formed is separated in a Gooch crucible, and after drying at 105°C. for 30 min. cooled and weighed, the weight of precipitate × 0·234 giving the weight of SO_2 present in the sample.—MIXING RAW SUGAR IN SAMPLING. **J. Vondrak.** *Zeitsch. Zuckerind. Czecho-Slov.*, 1929, **54**, No. 13, 125-128. According to the writer, the directions given in the recently published "Uniform Methods"[2] are insufficiently precise for the sampling of raw sugar, and he accordingly suggests the following additional directions:—Samples are taken from a sufficient number of bags by means of a probe, and introduced into a large sieve (constructed with brass wire of 6 mm. with meshes of 4 to 5 mm.), which is placed directly over a larger container. The sugar in the sieve is mixed with a circular motion simply with the hand or with a wooden spatula, any lumps left behind being gently crushed, so that all the sugar passes through. Then the sugar in the container is similarly energetically mixed with a circular motion with hand or spatula, taking 2 to 3 mins. for so doing, after which sample bottles are filled.—REPORT OF THE NEW YORK SUGAR TRADE LABORATORY. **F. W. Zerban.** "The total number of samples polarized during 1929 was 24,624, the highest in the history of the Laboratory, these representing an average of 1620 packages each, against 1666 in 1928, and 1648 in 1927. The average polarization of all samples was 96·57, which is 0·16 higher than for the previous year. The difference between the highest average monthly polarization (96·68) and the lowest (96·42) was only 0·26, much less than ever before. The percentage of samples testing between 96 and 97 has slightly risen, from 63·07 in 1928 to 63·18 in 1929, and that of samples between 97 and 98 has increased from 17·25 to 22·23. The relative number of samples polarizing between 95 and 96 has fallen further from 15·15 per cent. to 11·73 per cent. Sugars below 95 polarization comprised only 1·84 per cent. of the total, compared to 3·82 per cent. in 1928.

J.P.O.

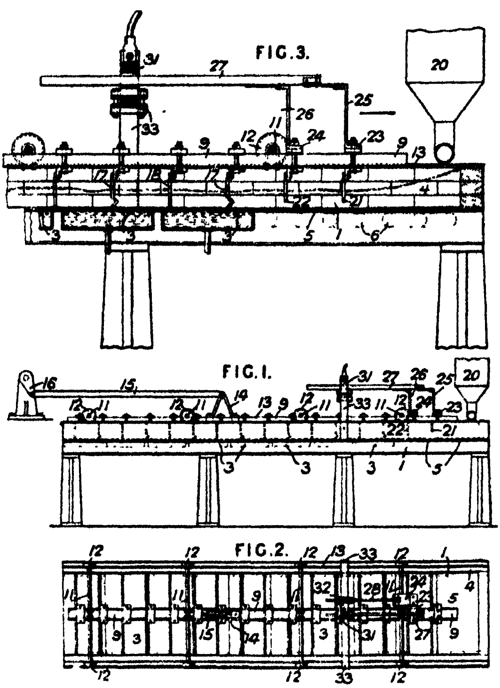
[1] *I.S.J.* 1928, 31. [2] *I.S.J.*, 1929, 36, 499.

Review of Recent Patents.[1]

UNITED KINGDOM.

Production and Revivification of Active (Decolorizing) Carbon.* **J. J. Naugle,** of Greenwich, Conn., U.S.A. 322,185. July 25th, 1928.

In producing active carbon (e.g., " Suchar "), or revivifying spent active carbon, comminuted carbonaceous material is heated in a shallow layer in the presence of air or other oxidizing gas while being subjected to a to and fro agitating action so as to move the charge forward and at the same time to expose substantially all the particles to the oxidizing action. In the example given, the material, which may be hot, is fed from a hopper 20 to a shallow open trough 1 lined with refractory material 4 and having a bottom formed of cast-iron plates 3, 5, the plates 3 remote from the feed end being water cooled. Electrode rakes 21, 22 and rakes 17, 18 extend into the material in the trough and are attached to a bar 9 which is carried on cross-bars 11 which have at their ends wheels 12 moving on tracks 13 on each side of the trough. The bar 9 is reciprocated by a link 15 connected at one end to a member 14 attached to the bar and at the other end to suitable driving mechanism, for example a crank 16. The material is electrically heated by current passing from one to the other of the electrodes 21, 22 through a substantial thickness of the material to the iron bottom and through the material again. An auxiliary heating means consisting of gas burners 6 is provided below plates 5. The charge may be heated to between about 425 and about 475°C., for example 450°C. The bottom plate 5 may, if desired, be of brickwork or other insulating material, the current passing through the charge from one electrode to the other. In this form the electrodes need not be raised from the bottom. The electrodes 21, 22 are secured to the bar 8 by clamps 23, 24 insulated from the bar by mica sheets, etc., and are electrically connected to the current source through uprights 25, 26 and bars 27, 28 which slide through slots in electric brushes 31, 32. A bridge member 33 carries the brushes 31, 32, mica or other insulation being provided therebetween. The rakes 17 are shaped to propel the charge forward, the rakes 18, 21, 22 being flat. The rakes 21, 22 may be shaped like the rakes 17. The material falls at the discharge end to the floor or to a bin or conveyor. For revivification purposes, where less combustion is desirable, the trough 1 may be covered, the air being admitted under control through dampers at the side and a flue being provided to remove the combustion products. Carbonized lignin residues derived, for example, from the alkaline liquors obtained in making wood pulp by the soda process may be used as raw material in the process.

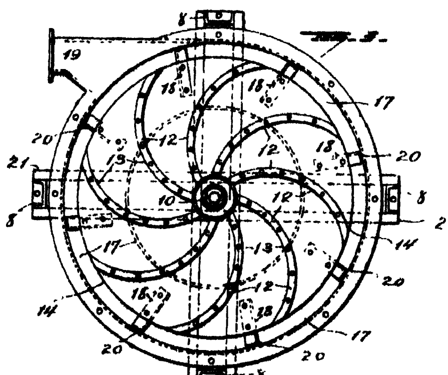


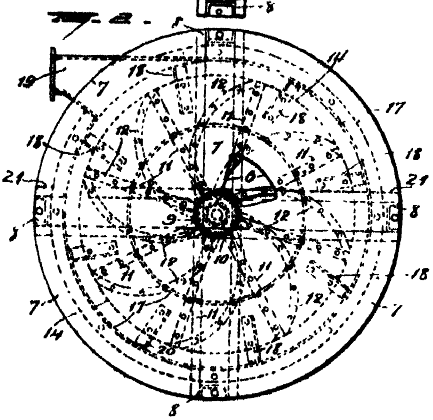
[1] Copies of specifications of patents with their drawings can be obtained on application to the following—*United Kingdom*: Patent Office, Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2 (price 1s. each). Abstracts of United Kingdom patents marked in our Review with a star (*) are reproduced from the *Illustrated Official Journal* (*Patents*), with the permission of the Controller of H.M. Stationery Office, London. Sometimes only the drawing or drawings are so reproduced. *United States*: Commissioner of Patents, Washington, D.C. (price 10 cents each). *France*: L'Imprimerie Nationale, 87, rue Vieille, du Temple, Paris. *Germany*: Patentamt, Berlin, Germany.

UNITED STATES.

DISINTEGRATING CANE. **William H. Morgan, Sr.** (assignor to the **Morgan Hurrycane Co.**, of New York). Re-issue, 17,513; original, 1,646,761. Re-issued December 3rd, 1929.

Cane cut into lengths about 6 in. long is fed into an opening 6 in the top member 7 of the rotary shear, which plate is held in place by the supporting member 8. The feed opening, located near the centre of plate 7, is circular in form and slightly conical. It is provided centrally with an opening closed by cap 9 which covers the upper end of shaft 10. This plate 7 is provided on its under side with a series of straight grooves which radiate from the centre of the member, and each groove carries a shear blade or knife 11 which latter is bevelled at its side edges and wedge shaped longitudinally, the thicker ends of the knives being adjacent the centre of plate. The knives may be bevelled at one or both side edges, but they may, if desired, be bevelled on one side only so as to form cutting edges which co-act with the knives 12 located within grooves 13 formed in the lower plate 14. This lower plate is circular in form, of less diameter than the upper plate and is rigidly secured centrally to the upper end of shaft 10. This lower plate is flat so that when combined with the upper plato a gradually decreasing spaco is formed between the two plates, the space in the outer edge or periphery being comparatively smaller and constituting the outlet for the sheared or fibrous material. The space between the two plates adjacent to the centre is considerably greater than the width of sugar cane stalk so as to permit the latter to be readily fed into this space and the centrifugal force set up by the revolution of the lower plate causes the material as it is sheared to flow outwardly toward the outer edge of the lower revolving plate.



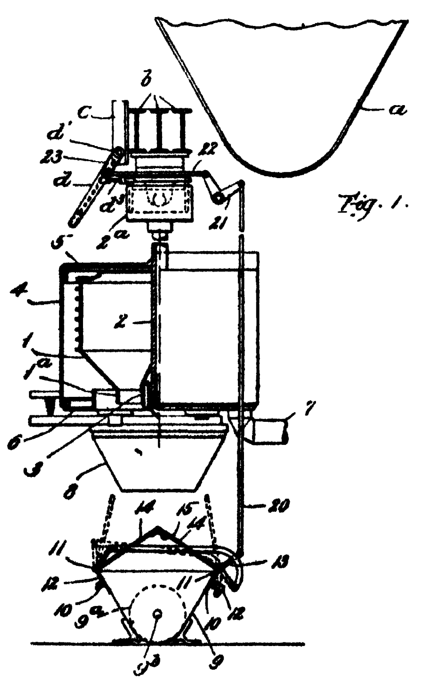


Secured to the top or fixed plate 7 is the circular trough shaped shield 17 which latter is secured to the underside of the upper disc 7 and projects downwardly, inwardly and upwardly and terminates well within the periphery of the lower disc 14, and close to the latter. This trough or shield 17 is so located that the shredded fibrous material which is ejected at the periphery of the rotary disc is caught up and carried around therein by the fan blades 18 which latter are rigidly secured to the underside of the plate 14, and operate by suction or air blast and by direct contact to carry the shredded material around and discharge the same through the spout 19, from which it is carried by a conveyor or otherwise to the juice extracting apparatus. The fan blades 18 project beyond the periphery of the revolving disc as shown and are enlarged at their outer ends as at 20, so as to project up approximately to or above the revolving disc 14 to engage the shredded material as it is ejected from the periphery of the disc. These blades are approximately as large as the cross sectional area of the trough or shield 17 so as to not only act as fan blades and create a blast or suction, but also to push the shredded material toward the discharge opening and

prevent clogging of the spout or shield. This shield or spout is as before stated secured by screw bolts to the upper stationary disc, and also on one or both pairs of cross beams 21 which are secured to the supporting member 8, which as previously explained carry the upper stationary disc or plate 7. Claim 3 : In an apparatus for converting sugar cane and like material into a fibrous mass consisting in a member having shear blades on its inner face, a second member having shear blades on its inner face, and means for rotating one of said members, and one of the latter being conical so that the space between them is greater at the centre than at the periphery so as to permit the cane stalks to be fed lengthwise or at right angles to the shaft carrying the movable member whereby the stalks will be carried around and shredded into fibrous hay-like sections in contradistinction to grinding them into granular particles, and the adjacent faces of the shear blades being approximately in contact a trough shaped shield embracing the periphery of the rotating disintegrating member provided with a discharge spout and means on the rotary member for projecting the sheared mass in the shield to the discharge spout of the latter.

CENTRIFUGAL MACHINE. **Eugene Roberts** (assignor to the **Western States Machine Co.**, of Salt Lake City, Utah). 1,721,491. July 16th, 1929.

In centrifugal practice the load of sugar in the basket, after it has been purged, washed and partially dried, is discharged through the bottom into an underneath receptacle, usually a trough container and scroll conveyor. As the sugar, when led into the basket from the overhead mixer, contains a large quantity of syrup, the accidental discharging of such into the scroll conveyor containing the purified sugar unfits the whole batch of sugar for the granulator. It is to avoid this trouble that the present improvement has been made. Generally speaking, the invention comprises, in combination with a suspended centrifugal basket and its surrounding curb, an underneath receptacle which is normally closed to prevent sugar from the centrifugal basket from flowing into it during the period that the basket is running, but which is opened for the reception of the sugar to be discharged when the brake is applied to stop the machine. If the driving belt of the centrifugal should brake or the driving motor should fail, the basket would stop of itself before the sugar was completely purged, washed and partially dried, but as the brake is applied only to slow down or stop the machine for the discharging operation, the opening of the receptacle is effected only when the load of purified sugar is ready for discharge. Any suitable actuating means for shifting the movable top or cover of the bottom receptacle may be provided, and in this case is shown a crank arm 13, secured to one of the rock-shafts 11, and having pivotal connexion with a vertical link 20, which is pivotally connected, at its upper end, to a bell crank lever 21, whose upper arm is connected by link 22 which, in the form actually shown, is pivotally connected with an arm 23 on the rock-shaft d', to which is secured the shipper lever d. This shipper lever is employed for starting the machine in the case of a belt-driven centrifugal, by throwing in the clutch pulley which drives the belt, or in the case of an electric machine by closing the switch which controls the motor current and by its reverse movement setting the brake to slow down the machine to low speed for discharging



and to stop the machine. The machine actually illustrated in the drawings is of the belt-driven type, and has a belt pulley 2^a secured to the upper portion of the basket-shaft around its centre of suspension and gyration, and according to the usual practice is provided with an interior expanding brake of a type similar to that illustrated, for example in U.S.P. 1,599,373, the brake being expanded or set to its operative or retarding position when the shipper lever d is thrown rearwardly either by hand or, as shown in the drawings, by a strong torsion spring d^2. A connecting link d^3, extending from the shipper lever d to the brake-expanding spindle d^2, serves to effect the expansion of the brake or its release as the shipper lever d is moved rearwardly or forwardly in the respective cases. Not only is this apparatus useful in case of accident for preventing the discharge of the load of massecuite or unpurified sugar into the receptacle for the purified sugar, but even in the ordinary centrifugal machine practice there is a tendency for the syrup or wet sugar to drip through the bottom of the basket when the machine is being loaded; and, as at that time the diverging cover above the scroll conveyor is in position for action, such drip is diverted away from the conveyor and does no harm.

METHOD OF REFINING SUGAR (APPLYING "SUCHAR" OR OTHER DECOLORIZING CARBON BY THE BATCH SYSTEM). **Eugene N. Ehrhart** (assignor to **John J. Naugle**, of Brooklyn, New York). 1,731,237. October 15th, 1929.

Desirable economies may be obtained by pre-filtering a batch of relatively low density, unfiltered, and undecolorized saccharine fluid of a relatively low degree of filterability with a batch of almost completely spent "Suchar" or other vegetable carbon or other purifying and filtering medium, after which the batch of saccharine fluid so pre-filtered may have its density increased by dissolving therein a certain amount of sugar solids or adding a more concentrated syrup thereto. After this again the partially decolorized batch of increased filtrability and purity and increased density may be treated with a predetermined amount of a more active or less spent "Suchar" or other vegetable carbon, or other purifying and filtering medium, and finally the batch of saccharine fluid thus obtained may have its density further increased by the addition of still another portion of sugar solids or of relatively concentrated syrup and the batch of still higher degree of decolorization and filtrability and of still higher density thus obtained may be treated with a pre-determined weight of virgin or relatively highly activated "Suchar" or other carbon or other purifying medium. One immediate result of this mode of procedure is the reduction of the amount of steam required. If the melt was filtered and decolorized so as to be supplied to the pans at an increased density, corresponding to about 4° Bé. or about 7·6° Brix higher than is feasible under the present practice, with crude oil at three and one-half cents per gallon, a saving would be effected of $37,000 per annum in a refinery of a capacity of five hundred (500) tons of sugar a day, calculating on a basis of three hundred (300) days a year, or a resulting saving of 24·7 cents per ton of sugar produced. This saving of 24·7 cents per ton of sugar produced, in the specific example being given, would apply to any installation irrespective of its size. The foregoing economies result in part from the fact that using a given quantity of "Suchar" or any other vegetable carbon or other filtering purifying medium, any ordinary saccharine fluid will filter more readily after it is totally or partially pre-filtered. Using a given purifying and filtering medium, such as "Suchar," for example, a pre-filtered sugar melt of a density of, say 29° Bé., which has already been pre-filtered by the use of a given weight of semi-exhausted "Suchar," could have its density increased, say, to about 33° Bé. by the addition of more original raw sugar being purified. The sugar melt of increased density could then be readily filtered through the same weight of "Suchar" in a less exhausted or virgin condition as the unprefiltered melt of lower density first referred to.

These considerations hold true even to a more marked degree of saccharine fluids of lower degrees of purity, such as molasses, "run-offs" and syrups, or any other saccharine liquors, as well as for the saccharine liquors customarily known as "melts," degrees Brix differing. In applying the principles of the present invention, it is desirable to so standardize the volumes and densities of the saccharine fluids

treated in successive stages, in accordance with the principles of the present invention, that substantially similar weights of almost completely spent, semi-exhausted and virgin "Suchar" or other carbon or other filtering medium may be used for the corresponding batches to be treated. This facilitates the manipulation of the successive batches of carbon of different degrees of activation. By using equivalent weights of carbon throughout the counter-current form of the method of the present invention as described above, which is the preferred form of the methods of present invention, the system will be unbalanced, as already referred to above, when conditions are such that the virgin carbon (being the carbon of highest degree of activation) is used on pre-filtered saccharine fluids, preferably on saccharine fluids which have been both pre-filtered and also subsequently subjected to a partial purifying action (such liquors being the most easily handled); and the semi-exhausted carbon (of a lesser degree of activation) is used on pre-filtered saccharine fluids, preferably on saccharine fluids which have been subjected to a single pre filtration treatment with almost completely spent carbon (such liquors being not quite so easily handled as the pre-filtered and treated purified liquors already referred to, but being more easily handled than unfiltered liquors); and when substantially completely exhausted carbon (of the lowest degree of activation and, in fact, possessing little if any decolorizing power) is used on incoming unfiltered liquors (offering the greatest filtration difficulties), all of the liquors treated being assumed to be of the same degrees Bé. or the same density. The system becomes balanced only when the densities of the various batches are so regulated, controlled and pre-determined and the amounts or volumes of such batches are so regulated, controlled and pre-determined as to enable the substantially completely or partially spent carbon from one batch of fluid to be used for pre-filtering another batch of fluid of lower degree of purity and lower density.

Turning now to one specific example of the methods of the present invention: Sugar, washed or unwashed, as desired, is dissolved in water to form a melt of a density corresponding to from about 18 to about 28° Bé. The melt after straining is pumped from the melter through a heater to mixing tanks where semi-exhausted "Suchar" or other filtering medium is mixed with the melt and the mixture sent to the filters. The filtrate flows from the filters to another melter where more of the original sugar is added to raise the density of the melt to the density required for sending the melt of increased density to the sugar boiling pans. This melt of increased density, the density of which may be from about 28 to about 30° Bé., is sent to a second set of mixing tanks in which virgin or unused carbon is mixed with it. This melt of increased density is now filtered, the resulting filtrate being sent to the sugar boiling pans. The carbon, now once used, is in a semi-exhausted condition and may be used on melt of lower densities in accordance with the principles of the present invention as described above. Instead of being treated in two stages, the final melt may be passed through more than two stages, such as three, or even four or more stages, the purity and the density of the melt at successive stages increasing, while the degree of activation of the carbon likewise increases for melts of higher densities and higher degrees of purity, just as the degree of activation of the carbon diminishes for melts of diminishing degrees of purity and lower densities. For saccharine fluids of lower grades than sugar melts such as syrups, run-offs, molasses, etc., substantially the same mode of procedure may be carried out, except, of course, that lower densities of solutions are used in the case of liquors of increasingly lower grades. For instance, the first liquor filtered with semi-exhausted carbon may be of a density ranging from about 12 to about 25° Bé., while the second batch of liquor filtered through virgin carbon may correspond to from about 22 to about 35° Bé.

CANE HARVESTER. **Henry O. Scranton**, of La Fayette, Louisiana. 1,726,043. August 27th, 1929. Claim 11:—In a cane harvester, a supporting frame, cutting devices for cutting down the canes arranged at the front end of the frame, conveying devices which engage the canes during the cutting operation, a transfer conveyor receiving the canes from the conveying devices and discharging them horizontally, said transfer conveyor being provided with means for operating it intermittently, and

elevator mechanism arranged on the frame and receiving the horizontal canes from the transfer conveyor and operating to raise the canes and to discharge them laterally of the frame. Claim 15 :—In a cane harvester, a combination of parts as set forth in Claim 11, the said elevator mechanism comprising an upright frame secured to the said supporting frame, a swinging elevator frame pivoted at its upper part to the upright frame, endless elevator members carried by the swinging frame and provided with means for operating them, means for oscillating the said swinging frame and the elevator members crosswise of the transfer conveyor, and a rotary cutting blade journalled in the said swinging frame and operating to top the canes while supported by the elevator members.—EVAPORATOR. **Philip B. Sadtler** (assignor to the **Swenson Evaporator Company**, of Harvey, Ill.). 1,735,979. November 19th, 1929. An evaporator comprises an evaporator body ; and a heating element projecting into the body, said heating element comprising a series of tubes through which the liquid to be treated may pass into the body, a steam drum surrounding the tubes, and a steam deflector interposed between the tubes and the drum to direct the steam downwardly along the outside of the tubes.—PROCESS OF EVAPORATION. **Philip B. Swenson** (assignor to the **Swenson Evaporator Company**, of Harvey, Ill.). 1,735,980. November 19th, 1929. The process of concentrating a liquid by evaporation includes forcing the liquid at high entrance velocity into an unobstructed relatively straight long and narrow high velocity zone, applying to the liquid in said high velocity zone heat in amount sufficient to boil the liquid and thereby augment its velocity, and permitting unobstructed discharge from said high velocity zone directly into the vapour space of a collecting chamber of the liquid and its vapour caused by boiling.—MANUFACTURING SUGAR. **Milton S. Hershey**, of Hershey, Pa., U.S.A. 1,740,693. December 24th, 1929. The process of manufacturing sugar from clarified sugar juice, which consists in boiling a mass of said juice, without addition, until its density is such that a small sample thereof will approximately retain the shape to which it may be moulded between the fingers of an operator, then agitating the boiled liquid mass, and drying the said mass during the agitation thereof until the whole liquid mass becomes converted into a free flowing finely divided crystalline solid sugar holding all the dried solids of the mother-liquor.—MANUFACTURE OF A SUGAR PRODUCT. **Walter H. Dickerson** (assignor to **Industrial Waste Products**, of Dover, Del., U.S.A.). 1,739,064. December 10th, 1929. The method of producing sugar in dry non-crystalline form from the sugar juices ordinarily processed to obtain commercial sucrose which consists in its entirety of filtering raw sugar juice to remove mechanical impurities and objectionable colouring matter, spraying the said filtered juice in finely divided condition into a hot normally gaseous drying medium to remove a substantial portion of the moisture content in said juice, and when the material is dry and while still in suspension in the drying gas, reducing the temperature of the material and the drying gas to thereby directly produce the finished sugar product in dry finely divided form.—CONCENTRATING AND EVAPORATING SYRUPS. **George R. Baker and Wm. E. Prescott**, (assignors to **Baker Perkins Co., Inc.**, of New York). 1,744,096. January 21st, 1930. Apparatus for concentrating and evaporating sugar syrups combines the following :—a concentrating vessel containing a spiral passage for the syrup, and vertical gas pipes surrounding the outer surface of said vessel and provided with burner nipples disposed tangentially to the surface of the concentrating vessel at different angles so as to cause the flames emitted to play uniformly over the surface of said vessel.—REACTIVATING CHARCOAL. **Charles N. Whitaker**, of Wilmington, Cal., U.S.A. 1,744,429. January 21st, 1930. A charcoal reactivator comprising : an outer shell providing a treating chamber ; an upright basket adapted to be removably supported and laterally spaced, in said treating chamber, having a charcoal chamber for the material to be reactivated, said basket having an inlet through which steam may be introduced into said basket and an outlet means through which said steam may pass from said basket into said treating chamber, and said basket being closed by a removable cover at its upper end and having a door near its lower end ; means for introducing steam into said basket ; and means for conveying steam from the lower end of the treating chamber.

United States.

(*Willett & Gray.*)

(Tons of 2,240 lbs.)	1930. Tons.		1929. Tons.
Total Receipts, Jan. 1st to Feb. 22nd	296,413	..	467,152
Deliveries „ „	376,417	..	468,037
Meltings by Refiners „ „	378,784	..	375,225
Exports of Refined „ „	8,212	..	15,165
Importers' Stocks, February 22nd	357,267	..	97,346
Total Stocks February 22nd	514,494	..	254,882
	1929.		1928.
Total Consumption for twelve months	5,810,980	..	5,542,636

Cuba.

STATEMENT OF EXPORTS AND STOCKS OF SUGAR, AT JANUARY 31ST.

(Tons of 2,240 lbs.)	1927. Tons.		1928. Tons.		1929. Tons.
Exports	4,260,274	..	3,852,024	..	4,818,309
Stocks	68,611	..	19,754	..	115,942
	4,328,885	..	3,871,778	..	4,934,251
Local Consumption..	161,107	..	73,200	..	99,693
Receipts at Ports to January 31st ..	4,489,992	..	3,944,978	..	5,033,944

Habana, January 31st, 1929. J. GUMA.—L. MEJER.

Sugar Crops of the World.

(*Willett & Gray's Estimates to February 13th,* 1930.)

	1929-30. Tons.		1928-29. Tons.		1927-28. Tons.
CANE.					
America	8,824,333	....	9,146,147	....	8,147,901
Asia	7,315,537	....	7,315,485	....	6,891,715
Australasia	601,000	....	630,717	....	588,163
Africa	695,000	....	745,364	....	656,360
Europe	10,000	....	11,610	....	10,552
Total Cane	17,445,870	....	17,849,323	....	16,294,691
BEET.					
Europe	8,299,762	....	8,429,552	....	8,031,874
U.S.A.	925,000	....	938,640	....	965,241
Canada.............	32,000	....	28,857	....	27,212
Total Beet	9,256,762	....	9,397,049	....	9,024,327
TOTAL CANE AND BEET....	26,702,632		27,246,372		25,319,018

United Kingdom Monthly Sugar Report.

Our last report was dated 10th February, 1930.

Markets all over the world have sagged and the two prominent features have been the efforts of the single seller in Cuba to keep the price up, and the unexpected small demand from the trade in almost every country.

The London Raw Terminal Market has been active and there have been some large transactions and big quantities have changed hands. After the March tenders this month became tight and has remained at about 6s. 5¼d., which is the last business reported. May, on the other hand, fell from 7s. 5¼d. to 6s. 7½d. A very large business was done in August, which month fell from 7s. 10½d. to 7s. December moved from 8s. to 7s. 6d. Since the 3rd March quotations have been made for deliveries from January 1931 onwards, the basis of the contract being c.i.f. instead of f.o.b. Hamburg, and on which Colonial sugars are no longer tenderable at a premium. January sold from 8s. 4½d. to 8s. 2¼d., March sold from 8s. 8¼d. to 8s. 6d.

In the White section business has been very slow, and again only a few thousand tons of business has been reported. The market on balance has declined about 6d. per cwt. About 3000 tons were tendered on March delivery, and this month sold down to 8s. 9d., May sold down to 9s. 3d. and August to 9s. 11¼d.

The latest prices are :—

	MARCH	MAY	AUGUST	DECEMBER	MARCH
Raw	6s. 5¼d. ..	6s. 7½d. ..	7s. 0¾d. ..	7s. 6d. ..	8s. 6d.
White ..	8s. 9¾d. ..	9s. 3d. ..	9s. 10¼d. ..	— ..	—

The proximity of the Budget has made trade buyers very nervous and they are continuing their policy of hand to mouth buying.

Refiners reduced their price 3d. on the 12th February, and on the 5th March they reduced their Granulated 6d. and their other makes only 3d. Their latest prices are, No. 1 Cubes 25s. 3d., London Granulated 21s. 7½d. Home Grown sugars have moved in sympathy and are slow of sale. To-day's prices vary from 20s. 3d. to 20s. 9d. according to factory.

There has been a little more activity in the sale of Raw sugars. Our Refiners again bought small parcels afloat and near at hand down to 7s.; April/May Cubans were sold at 7s. 4½d. and about 125,000 tons of Cubans were sold for delivery May up to September at 7s. 9d. c.i.f.

There have been again many rumours emanating from Cuba and New York with regard to restrictions of the Cuban crop, and also that the single selling agency will be abolished. So far, nothing very definite has materialized. The single seller has sold a further 180,000 tons at 1.50 f.o.b. for export outside the U.S., 55,000 tons of which was sold to Russia. The price for America of 2 cents has not attracted buyers, who have been buying the free duty sugars at a much lower price. The latest rumour is that the duty in America is to be raised to $2.50 and this has stimulated the near positions on the New York terminal exchange, which has been very flat.

With regard to Europe there is no fresh news of the crop. Mr. F. O. Licht estimates that there will be a slight increase in the sowings next crop.

21, Mincing Lane,
London, E.C. 3.
7th March, 1930.

Arthur B. Hodge,
Sugar Merchants and Brokers.

THE

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The Editors will be glad to consider any MSS. sent to them for insertion in this Journal, and will endeavour to return the same if unsuitable; but they cannot undertake to be responsible for them unless a stamped addressed envelope is enclosed

No. 376 APRIL, 1930. Vol. XXXII.

Notes and Comments.

The Plight of our Sugar Colonies.

Elsewhere we give summaries of the detailed Reports just published by the Government on the results of the official investigations carried out both in the West Indies and in Mauritius into the economic position of the staple crop of the islands. Both the West Indian Sugar Commission, consisting of Lord Olivier and Mr. Semple, and the Mauritius investigator, Sir Francis Watts, come to a like conclusion, which is that when free sugar in the world market is selling like bankrupt stock, and most sugar industries have the aid of a protected market and various degrees of subsidy to assist them, it is futile to expect our sugar colonies in the Caribbean and the Indian Ocean to make a profit without a like degree of aid; even the existing preference is not sufficient to allow profits to be made while sugar prices are so abnormally low, all the more so while the market for British sugar has been hampered by the uncertainty as to whether the Labour Government at home intends to continue that preference or not.

The West Indian Commission went very carefully into the figures of the average cost of production within their sphere of enquiry and taking the market prices at the end of December as their basis (which prices have since fallen still lower) they found that the average cost of production was about £12. 7s. 6d. f.o.b., whereas the market price even with the aid of the preference was only £10. 10s. There was therefore a loss on production of nearly £2 per ton, which sum is taken as the round figure of the loss in present circumstances. In Mauritius where, Sir Francis Watts states, the cost of production is below that of all foreign countries except Java, and possibly Cuba, the general loss to the industry under current prices may be put at broadly £1 per ton. In neither case, then, is it possible for the planters to carry on save at a loss, and if aid be not forthcoming it is only a question of time before all further cultivation is abandoned and the sugar industry is faced with more or less complete ruin.

This bare truth became so obvious to Lord Olivier as his investigations proceeded, that he could allow no political considerations for his own party government at home to temper the severity of his conclusions as to what would follow if the West Indian sugar industry was for fiscal reasons abandoned to its fate. He and his colleague make some very definite recommendations: they would guarantee to West Indian sugar a price of £13. 10s. per

ton f.o.b., and to allow this to be done they suggest the setting up of a single purchasing agency in this country so as to average the cost over all the sugar consumed ; they would as a temporary measure have the preference increased from 3s. 9d. to the Canadian level of 4s. 8d. and this in spite of the fact that when they received their instructions from the Government last Autumn they were told that any increase in the preference was not a solution that the Government would be disposed to entertain. In any event they urge that the ordinary sugar duty should not be reduced below that sum of 4s. 8d., so that Imperial sugar by coming in free can obtain that amount of preference as a minimum, pending the establishment of a single buying agency. In the case of Mauritius, Sir FRANCIS WATTS asks for a grant-in-aid representing the difference between the cost of production (£13. f.o.b.) and the average selling price of the crop.

The two Reports have had a good press reception at home, and though one or two free trade papers have made the most of certain references to the need for improvement in some sections of the West Indian industry, the press as a whole has realized the stern necessity of giving relief to the urgent needs disclosed ; and the Government, and Mr. SNOWDEN in particular, have come in for considerable criticism for their refusal to offer any adequate aid at once, or to anticipate the intentions of the Budget which is due to be unfolded about the time this issue of our journal appears. LORD OLIVIER, both in his place in the House of Lords and in the columns of the press, has been in the vanguard of criticism of the Government, and since he is a Labour peer and was doubtless chosen for his task in the hope that his report would refrain from clashing with the Free trade predilections of his party, his criticisms of the Government attitude have been all the more damaging and the more difficult to parry.

The Government's Responsibility in the Matter.

We do not propose for the present to discuss the Reports with their recommendations and implications at any length, since it will be more convenient to wait till the Budget proposals of Mr. SNOWDEN reveal what effect on his fiscal inclinations these revelations of the needs of the British sugar industry will have. He has himself admitted having been impressed by the data and the arguments put forward, and at the time of writing it is not thought that he will take off the sugar duties this year and thereby abolish the preference ; whether he will accede to the request to increase it for the time being, we shall know on Budget Day. By then Mr. SNOWDEN may conceivably have modified his intentions in the light of the severe criticism to which he has been subjected, but at the time the Reports were published, the Government issued to the Houses of Parliament a brief Statement of Policy which suggested that the Government could not deal with the difficulties by way of preference and that they could not entertain the cost of giving effect to the guaranteed price of £15, or to the grant-in-aid proposed by Sir FRANCIS WATTS. Will the Budget turn out to have some alternative offer in store ?

If we leave out of the argument for the moment the ethical question of whether we at home are in duty bound to come to the aid of our colonies in their crisis and confine ourselves to the question of cost, the price to be paid to rectify the losses seems a very small item in our total Budget figures. LORD OLIVIER has submitted figures to the press showing that on last year's basis of imports of Colonial sugar the amount needed to increase the preference to the Canadian rate would be about £530,000 additional at 18s. 9d. per

ton. On that basis too, the amount needed to make up the calculated loss of £2 per ton would be under £1,200,000. LORD OLIVIER reckons that one farthing per lb. added to the price of sugar in this country would make good that loss of £2 per ton. But unfortunately since last December the price of sugar he then took as his basis has fallen and now stands at about £7. 10s. per ton. To guarantee a price of £15 per ton c.i.f. to Colonial sugar means at present-day prices doubling the preference of £3. 15s. (or doubling 0·4d. per lb.) and works out at over two millions extra. It is difficult to believe, though, that prices will remain as low as £7. 10s. per ton throughout the next twelve months.

The Government are undoubtedly faced with heavy fiscal liabilities at home which must make them demur to increasing their expenditure or decreasing their income from revenue duties. And they are probably disposed to argue that if we are to come to the assistance of the West Indies by fiscal expedients, there are a number of harassed industries at home that might claim equal consideration. But sugar is the staple crop of the West Indies, and no other can be substituted in its place, nor is there any other of like magnitude to average the loss. It is probably true to say, as is being done, that it would cost the Government more to ruin the West Indies than to see them through the present crisis. For example, it would cost them, it is calculated, some two millions sterling to repatriate all the immigrants at present working in the West Indian canefields, while this country's industry would lose the best part of their West Indian trade, worth about six millions sterling, a good slice of which comprises sugar machinery and equipment. Mr. AMERY in this connexion has pointed out that the annual exports of sugar machinery from the United Kingdom from 1920 to 1928 averaged a value of two millions sterling, one third of which went to the British Empire, and that if this third were cut off it would make it more difficult for the industry to compete for the remaining two-thirds. The Government have also been reminded that the country has for some little time been buying its sugar at what are aptly termed bankrupt stock prices, and can very well afford to pay the slightly higher price needed to finance the West Indian deficit. All things considered, the Government have no light task in dealing with the West Indian question, viewed merely as a fiscal issue.

They have indeed gone so far as to make a preliminary offer in advance of the Budget, a sort of palliative in the shape of a loan not exceeding £150,000 for the West Indies and £100,000 for Mauritius on condition that the insular Governments guarantee a like amount. But the total of £500,000 is not half the sum of the losses in sight, and appears to be guaranteed merely in respect of the ultimate loss of a small proportion of advances made by the banks to the sugar producers and is thus only a trifling proportion of the security which the banks would require before making advances to the planters. The proposal has therefore been stigmatized as "Dead Sea fruit" and has been unanimously rejected by the colonies concerned. These expect something more substantial than this illusory offer.

The Cuban Position.

With the British Colonial sugar crisis filling the bill this month, there is not much of immediate moment in the economic world to notice this issue. The future course of the sugar market hangs largely on Cuba's ability to continue "single selling." We have had a month of rumours (many of them, one thinks, based on the wish being father to the thought) as to the pending dissolution of the CEA. It is clear that for lack of proper co-ordination and

co-operation in the Cuban sugar industry, diverse views with regard to this agency have been allowed undue play, and the pendulum of rumour to swing freely on comparatively inadequate grounds. What we do know is that the CEA has stuck to its task amid a fire of criticism, in the belief that it had enough support from its stockholders to maintain itself in existence in spite of every one on the outside. The matter was actually put to the vote on March 31st and resulted in 12,918 voting for the retention of the agency and 11,139 voting against. There are solid reasons why the agency should continue to function, and our Cuban correspondent on another page details some of the advantages that have already been achieved. Certainly the CEA ought to be allowed to finish the present crop. The advantages of its policy have still to develop and should do so in the next few months. Incidentally, Cuba is negotiating with Russia to take half a million tons of Cuban sugar to fill up the undoubted deficit of the crop in that country, and if the bargain comes off, it will leave Cuba at the end of the season with no more sugar than she may reasonably expect to dispose of to her ordinary customers this year.

British Sugar Beet Society's Report.

The Report of the British Sugar Beet Society for the year 1929-30 lately issued states that whereas in 1928 there was a reduction in acreage sown in this country of some 47,000 acres, in 1929 a marked improvement took place, and the final return gave 232,000 acres, or 54,000 more than in 1928. But the weight of roots per acre, notwithstanding a very favourable season, proved still disappointing, being only 8·65 tons on the average, or just above that of 1928. Yet, although the average was so low, many excellent crops were grown; the Mason Challenge Cup was won with a crop of 18·3 tons per acre and a sugar content of 18·82 per cent., which works out at 3·44 tons of sugar per acre. In addition, a number of growers who did not compete for the cup returned high yields, the best quoted being 22·5 tons per acre with 19·1 per cent. of sugar, or 4·30 tons sugar to the acre. In view of these results, the Society considers it a standing reproach to any farmers contracting to grow sugar beet that they can only produce 3 or 4 tons of roots per acre. Failure to obtain competent advice is at the back of these poor returns. As for the sugar content, it averaged 17·7 per cent. and would have been higher had not late rains started re-growth and reduced the sugar. Nineteen factories operated during the campaign.

The amount of sugar produced in the 1928-29 campaign was finally stated as 195,200 tons; in the last campaign the provisional results indicate the total as 290,000 tons. During 1930, the last year with the subsidy at 13s. per cwt., the contracts for growing beet amount to 315,000 acres, or some 83,000 acres more than in 1929. In 1931 the subsidy will be reduced to 6s. 6d.

LORD ERNLE, the President of the Society, is not accepting nomination for another year, and the EARL OF YARBOROUGH takes his place as President for 1930-31.

American Sugar Refining Company's Annual Report.

For the year 1929 the American Sugar Refining Company treated 1,257,842 tons of raw sugar at a profit of $8,166,361, or of about ¾ cent per lb., after providing for taxes and depreciation; this compares with 1,217,336 tons and $8,016,437 in 1928, and 1,301,670 tons and $3,070,851 in 1927. The sales volume in 1929 amounted to a total of 143 million dollars, of which about 32 millions was paid to the Treasury as Customs duty.

Notes and Comments.

Mr. Babst, in the course of his annual report as Chairman, remarks that progress in the sugar industry of the world in the matter of reaching a balance between production and consumption has been slow, largely owing to political economics in almost all countries. No other world commodity is so universally subject to political direction or under so many different systems of legislation and, accordingly, affected by so many changes and political experiments with consequent uncertainties as is sugar. In the present period of low prices more than 100 countries have set up systems of taxes, duties, excises and bounties, all calculated to help producers within and to penalize producers without their national boundaries.

The year just past has developed little change in the fundamentals of the sugar industry in the United States and Cuba. They continue in a period of overproduction and of low prices, in which the Government through the tariff is the only factor realizing any substantial return. As stated in previous Reports, the unstable conditions in the industry revolve around : (*a*) the effort of the market to reach a balance after the violent changes incident to the action by various governments, including the U.S. ; (*b*) the excess capacity, both of the United States refiners and of Cuban sugar producers, called out by the war effort of the United States and of Cuba, and by the foreign demand in the years immediately following the War ; and (*c*) the taxes and duties throughout the world and their frequent changes introducing great confusion and uncertainty in international trade.

As for Cuba, Mr. Babst remarks that her record crop of 1928-29 — 5,156,000 tons —was but little larger than the last previous unrestricted crop, that of 1924-25 ; and in the intervening years Cuba lost by restriction a total of nearly two million tons of sugar, the amount represented by the difference between the actual crops and the 1924-25 level of production. On the other hand, the producers of the United States, Porto Rico, Hawaii and the Philippines increased their production during the corresponding period. This increased production displaced Cuba correspondingly and directly—and perhaps permanently. Even with Cuba back to its record crop figure, production has increased in the world, and largely also behind tariff barriers, to such an extent that in 1928-29 Cuba produced less than 19 per cent. of the world supply, compared with almost 22 per cent. in 1924-25—a further loss of markets for Cuban production.

The United States refineries, as has more than once been stated, possess an excess capacity of over 50 per cent. of the maximum requirements of the country. Hence even if the consumption were to increase at the average rate of 5 per cent. annually, it is apparent it would take eight or ten years before consumption would employ the capacity of the refineries already built.

West Indian Sugar Crop Reports.

The following is the gist of the reports of Barclay's Bank (D. C. & O.) on the British West Indies for the three months ending with February. *Barbados.*—Trade has remained dull, owing to the continued depression in the sugar industry, and will probably continue till after mid-April. Conditions have been favourable for the reaping of the 1930 sugar crop, the "old" canes being in good condition, and the early returns are reported to be good, while there are anticipations of improvement later. *Trinidad.*—Continuous rains experienced throughout the latter half of November were succeeded during December by dry weather. The grinding of the 1930 sugar crop was

begun about January 6th, and has been favoured with suitable weather conditions. Estimates place the total sugar crop at about 5000 tons less than in 1929, when it amounted to 89,926 tons. *Jamaica.*—Trading conditions have become very dull and the purchasing power of the community is at a low ebb. The grinding of the 1930 crop commenced as usual in January. *Leeward Islands.*—First rough estimates of the 1930 sugar crop in Antigua place the output at about 17,500 tons. That of St. Kitts is estimated at about 16,000 to 17,000 tons. The weather, on the whole, has been favourable to cultivation. *British Guiana.*—Considering the time of the year, the weather proved extraordinarily dry during December and more rain was needed in the canefields ; but subsequently a period of rain was experienced, to be followed again by seasonable dry and cool weather. The 1929 sugar crop exceeded estimates by about 10 per cent. The new 1930 crop is showing juice of good quality and returns are above the average.

Chartering Ships for Sugar.

A correspondent sends us some details of recent sugar chartering which are not without interest in these days of abnormally low prices. The shipping of a large proportion of the Mauritius crop to this country has been an annual event for some years, but the latest contract appears to have aroused some interest in sugar and shipping circles, the Clan Line having secured the business of shipping some 100,000 tons of this sugar. This task will require fully fourteen steamers to convey it to the United Kingdom. The shippers took advantage of the very depressed state of the chartering markets to secure their tonnage at the low rate of 22s. per ton. Steamers in all parts of the world are practically going begging and the abnormal quantity of idle tonnage is growing daily, so that the shippers had no difficulty in placing the order at their own price. Terms for sugar from Mauritius to the U.K. at this time last year were fully 26s. per ton and 35s. 6d. per ton in 1927, although only 23s. 6d. was obtained at mid-December last, and business since has been at a standstill. It is understood that this sugar will be shipped from September, 1930, to January, 1931.

Some activity has also latterly been shown in sugar chartering from Cuba to Europe although that country has not the last few months sent much sugar to that destination. There has been a considerable falling off in freight rates to the U.K.-Continent in sympathy with the depression prevailing in practically all other directions. Several boats leaving the River Plate in ballast have been picked up at cut rates by Cuban sugar shippers, and tonnage was recently fixed to the U.K.-Continent at the extremely low rate of 13s. for March-April loading. This figure compares with 15s. obtained in January, 1930, and 18s. 6d. up to 20s. per ton in March, 1929. Terms for forward loading have also fallen appreciably, tonnage for June loading recently being fixed at 14s. 3d., which is about 7s. per ton below the normal rate. Sugar chartering has also been effected from San Domingo at the low rate of 13s. to the U.K.-Continent for April loading for 6000 tons, and at 14s. from Port-au-Prince to the same destination for a small steamer of 2500 tons for prompt shipment.

It is clear, then, from the above figures, that it is not only the sugar producers who have fallen on evil times, but that the shipowners, owing to over-production in ships, have met with a like predicament and are being forced to accept what must be deemed unremunerative rates. For the time being the refiner and the consumer in the United Kingdom are having all the advantages.

The Report of the West Indian Sugar Commission.

The Need for Immediate Assistance.

Last September the Colonial Office requested LORD OLIVIER (a former Governor of Jamaica), and Mr. D. M. SEMPLE (of the firm of Mirrlees Watson Co., Ltd., Glasgow) to proceed to the West Indies and investigate the causes of the present depression in the sugar industry there and report on any measures considered necessary, to place the industry in the best possible position for the future, as also for the temporary assistance of the industry. The Colonial Secretary (LORD PASSFIELD) was influenced in this decision by representations made by various governing bodies in the West Indies, and West Indian chambers of commerce and agricultural societies, that the sugar industry there was experiencing a severe crisis, and could no longer be carried on save at a loss ; that estates were going out of cultivation, and that there was grave risk that many other estates would follow suit, with the result of serious distress ensuing amongst large numbers of the population.

The Commissioners accordingly went to the West Indies and toured the different territories, returning to England at the end of January by way of Cuba and New York. They cabled a preliminary report of their conclusions to LORD PASSFIELD on December 31st, urging the imminence of the danger threatening the West Indies. The main report was presented to the Government at the beginning of February, but it was only on March 25th that the Report was published.

The Sugar Commissioners came to the unqualified conclusion that the sugar industry in the British West Indies was in need of general and immediate assistance, and they summarized their recommendations in the following terms :—

(1) His Majesty's Government should make a resolute endeavour to eliminate, in concert with other Powers, the disturbing factors of high tariffs and subsidies.

(2) Meanwhile, a single purchasing agency should be set up to purchase all sugar for the United Kingdom, buying Imperial sugar at £15 per ton c.i.f., and other sugar at the market price.

(3) By way of an immediate moratorium, the British preference on Imperial sugar should be raised as quickly as possible to 4s. 8d. per cwt.

(4) Pending the conclusion of an international agreement as in 1, or the establishment of a single purchasing agency as in 2, the duty on sugar should not be reduced below 4s. 8d., under which tariff Imperial sugar would be admitted free provided the total price obtained does not exceed £15.

As a condition of the assistance recommended, the Colonial Governments should take effective action to prevent the sale of foreign sugar in the Colonies at less than the f.o.b. price of Imperial sugar.

Among other general measures recommended are the establishment of (*a*) alternative industries where possibilities exist, e.g., rice in British Guiana, and fruit culture in the Leeward Islands, and (*b*) a West Indian Sugar Technologists' Association, possibly with assistance from public funds.

THE MAIN REPORT.

The Report itself consists of a blue book of some 124 pages,[1] most of which is encompassed within three " Parts." Part 1 comprises the detailed reply to questions referred to the Commission and the recommendations for early action ; Part II is a survey of the World Sugar Situation and of the

[1] Published by H.M. Stationery Office, London, Cmd. 3517. 2s. net.

General Situation in the British West Indies, while Part III covers the situation in the several colonies. Part I is the main Report, the rest being merely subsidiary to its arguments, and we give below abstracts and summaries of its contents.

"It is estimated that in the twelve months ended 31st December, 1929, there were placed upon the markets of the world 28,200,000 tons of sugar, but that the consumption was a trifle under 27,000,000 tons. The over-production of last year followed similar excesses of production in previous years. Dr. Mikusch estimated that from 1923 to the beginning of 1929 there had accumulated an unmarketed surplus of about 3½ million tons of sugar held in various parts of the world. In New York we learned that at 1st December, 1929, stocks of sugar in Europe, the United States of America, and Cuba amounted to 5,218,000 tons. This is an increase of 1,181,000 tons over stocks at the same points a year earlier.

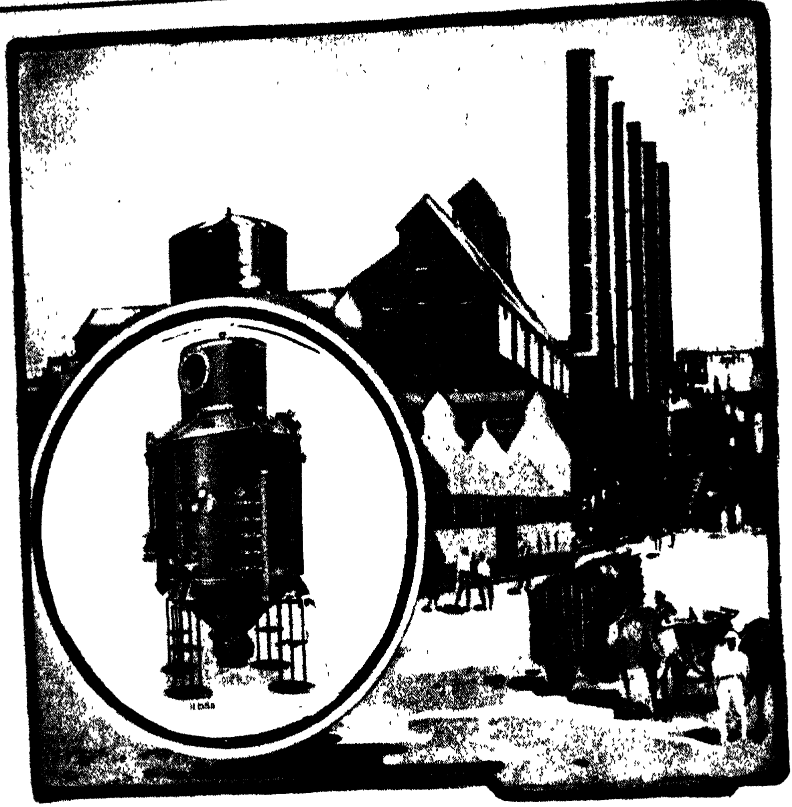
"This position of affairs has produced an intense depression of price, the average open market price of sugar in London having fallen from 25s. 9d. per cwt. in 1923 and 21s. 9d. per cwt. in 1924 to 9s. 3d. per cwt. during the first five months of 1929, during which the representations from the Colonies were received. The price on the 31st December, 1929, was 8s. 3d. per cwt.

"Our examination of the costs of production of sugar in the chief producing countries shows that, in consequence of the operation of tariffs, the consumers of sugar throughout the world pay very much more for sugar than it costs to make it, while the producers of sugar are now offered in the free markets of the world a price lower than the general cost of production anywhere, with the possible exception of Java, where exceptionally favourable natural and social conditions are combined with a super-abundant supply of labour paid at half the wage rate paid in Barbados.[1] All but very few producers outside of Java for the free markets must consequently be experiencing losses."

The relief normally to be expected from a steady increase in consumption is interfered with by the enormous pressure for sale of stocks already accumulated, and by the restricted capacities of free markets; also by the incentive to continued over-production offered by subsidies, by the temptation to Cuba, thanks to her tariff preference in the United States, to dump surplus sugar, and by the temptation to Java to take advantage of her low costs of production to drive other competitors out of the world's free market. "There appears, accordingly, to be no reasonable ground for expecting any early restoration, under existing conditions, of the market prices of sugar to figures which will enable the present rate of production to be maintained without loss to unprotected or unsubsidized producers." "It is, therefore, unquestionable that the sugar industry is experiencing a severe crisis and that the crisis must, under present conditions, be expected to persist for several years to come."

The submission of the West Indian Colonies, that sugar can no longer be produced in them except at a loss, the Commissioners consider too general a statement to be summarily and completely endorsed. They enjoy at the moment a market protected to the amount of 3s. 8·8d. per cwt. In the 1929 crop small profits were made in certain cases, at any rate by the factories; but in these cases it is maintained that the planters mostly supplied their canes at a loss. In any event, no profit was in many cases left for capital and no provision for depreciation. "On the whole, it may be stated that, at

[1] Java, 10d. per day; Barbados, 1s. 8d. per day.



The Inset above shows a VACUUM PAN—COIL TYPE

present prices, equivalent to £10. 10s. per ton f.o.b.[1] including the British tariff preference, the greater part of the West Indian production of sugar cannot be carried on except at a loss."

A number of 1928 cost statements were submitted to the Commission, the amount of sugar covered by them being 292,284 tons; from these the average cost in sack at factory worked out at £11. 17s. 6d. per ton, to which sum about 10s. should be added to get the f.o.b. cost. Of this quantity 7·1 per cent. was produced under £10 per ton, 16·6 per cent. at £10 to £11, 32·8 per cent. at £11 to £12, and 25·9 per cent. at £12 to £13 per ton, while the remaining 17·6 per cent. cost from £13 to over £15. The total output of sugar produced that year in the West Indian colonies was 368,725 tons, but no cost statements were received covering the balance. On the above figures, West Indian sugar in spite of having a preference equivalent to 31 per cent. of its sale price suffers a loss of £1. 17s. 6d. per ton (1s. 10½d. per cwt.).

Suggested Measures for Permanent Improvement.

Dealing with the measures which they consider should be taken to place the sugar industry in the best possible position for the future, the Commissioners state :—

"As regards research, we think it most important that the studies which originated and have for many years been carried on in the West Indian Colonies into means for repressing disease and improving strains of cane, especially the latter, should be continuously and energetically pursued, and that increased expenditure should be applied to the propagation and distribution of such improved varieties of cane as may prove themselves suitable.

"The cultivation of sugar cane has attained a fairly high standard in most of the West Indian Colonies, and the planters are well to the fore in the methods of cultivation which they have adopted to suit the peculiarities of soil and climate in each locality. Granted a stable outlook for the industry for a period of years, many would improve their methods by the more extensive use of mechanical tillage.

"In the better organization of production lies the greatest opportunity for improvement in a number of the Colonies. The centralization of production has been perfected in St. Kitts and in the south of Trinidad, to a less degree in Antigua, British Guiana, and the north of Trinidad, whilst it can be said to have only fairly commenced in Barbados and Jamaica. The general trend, however, is towards better organization, and if prices can be stabilized at a point to encourage production under conditions such as exist in districts served by central factories, further development can be expected along these lines. Rapid improvements in manufacture have been made in the larger factories, but the average recovery of sugar is to-day in a very large number of cases far below good practice. To bring the equipment of some of these factories up to modern standards will entail expenditure of considerable sums of money. This money cannot be found under existing conditions.

"For the improvement of the technique of the industry as a whole we advocate the formation of a Sugar Technologists' Association, as has been done in all progressive sugar-producing countries to-day, including Cuba, Java, Hawaii, Natal, and recently India, whereby comparative reports may be exchanged, technical papers read and discussed at an annual meeting, and all producers—agriculturists, transport workers, and factory operators—may more fully realize that collective work, and co-operation will produce more

[1] £8. 5s. open market price; £3. 15s. preference; £12 preferential price, c.i.f. Deduct £1. 10s. freight and charges.

rapid advance than the present individualistic methods. Such an Association will probably not be self-supporting and might reasonably receive some assistance from public funds. In other countries these Associations are assisted by donations from the factory owners, who recognise the great advantage such an organization is to their business.

"It appears to us evident that, while improvements can be made in particular cases, the present depression of the British West Indian sugar industry is not due to any general lack of efficiency and cannot be remedied effectually by improvements in methods of production alone."

The Need for Immediate Assistance.

The question of the immediate assistance required for the industry as a whole next receives the Commissioners' consideration. As to the need for it, they are emphatic. "If the protection now afforded by the existing tariff preference in the British market were suddenly withdrawn through the abolition of import duties on sugar, there could hardly fail to be an immediate disastrous collapse in Barbados, St. Kitts, Antigua, and British Guiana, which would entail results which we do not think it possible for any British Government to contemplate without taking measures to avert it. The same is true in a less degree in Trinidad and St. Lucia. The effects in Jamaica would be severe, but not equally crippling."

It is pointed out that while West Indian sugar enjoys a preference in Canada of 4s. 8d. per cwt. on 96° sugar, at present producers receive a portion of that preference only very slightly in excess of the amount of the U.K. preference, and if the latter were abolished the sugar would lose the greater part of the benefit of the Canadian preference, and would command prices little above the general world level (on December 31st, £8. 5s. per ton).

No suggestions of better organization, no improvement of agricultural practice or methods of manufacture could possibly make the difference between the survival and the destruction of the West Indian sugar industry should the preferential protection be entirely withdrawn. Were the worst to happen, the industry would rapidly cease to exist, being reduced so far as its exports were concerned to the production of a negligible amount of fancy grades of sugar, syrups and rum enjoying a limited special market. The world position of the sugar industry is so serious, it is pointed out, that even well-equipped modern factories in Cuba, three to five times as large as the largest equally well-equipped factory in the British West Indies, are in financial straits and unable to pay cane-growers a fair price. So, "should the duties on sugar be abolished in April next, without any prospect of an adequate safeguard in substitution, the general winding-up of the West Indian sugar industry would immediately be taken in hand, and any recommendations which could be made for improvements in the efficiency of its production, including research and the activities of the Imperial College of Tropical Agriculture in Trinidad, would be entirely thrown away."

In the course of the Commission's enquiries they were in receipt of suggestions as to the only conditions under which the industry could at all be maintained. These reduced to three in the main. One was an increase in the preference, ranging from 1s. to as much as 2s. 6d. per cwt.; another was the granting of a bonus per ton of sugar, to take the place of the sugar duties if abolished, at the rate of half the present subsidy granted to the British sugar beet industry or say 5s. 8d. per cwt. and to be continued so long as the beet subsidy runs; the third expedient was that a fixed price for West Indian (and

other Imperial Colonial) sugars should be guaranteed in the British market, for which all sugars should be purchased by a single buying agency. The first proposal is rejected as being "far from the most economical fiscal method devisable for the purpose." The second is deemed to be liable to "create a situation which was not contemplated when granting a subsidy to establish a new industry in the United Kingdom." It is, therefore, the third expedient that appeals most to the Commission, and on it they have based their concrete proposals for immediate assistance to the sugar industry.

They recommend the establishment of a single central authority to buy and distribute the whole of the sugar consumed in Great Britain. This authority would buy Imperial sugars at the allowed price, so long as the price at which it could obtain sugars elsewhere did not exceed that price. Should it exceed it, the Imperial sellers should receive the world market price. So long as it did not exceed it, the sugar supply of the United Kingdom would be distributed to its customers at a price sufficient to cover the pooled cost of the sugar bought in the open market and the Imperial sugar purchased at the fixed price. This arrangement would be on the lines which have frequently been advocated for dealing with wheat supplies.

The fixed price recommended should be, under present conditions, about £15 per ton c.i.f. for 96° sugar, which corresponds to a price of approximately £13. 10s. per ton f.o.b. Assuming that West Indian sugar is produced, as above mentioned, at an average cost of £11. 17s. 6d. per ton in sack, and allowing 10s. per ton to cover f.o.b. expenses, and £1 for depreciation and interest on capital, this makes the average f.o.b. cost £13. 7s. 6d. "The price proposed, which should be subject to adjustment from time to time, appears to us to be low enough to make it impossible for any but reasonably efficient production to be carried on at a profit, while it should be high enough to offer some incentive to those proprietors who wish to make improvements in their factories or cultivation, and afford a reasonable return on capital invested in such improvements."

Pending a solution of the problem on the above suggested basis, the Commissioners recommend that the Preferential allowance to Empire sugars should be augmented to an amount at least equal to the preference granted by Canada (4s. 8d. per cwt.). This rate may not cover entirely the average bare cost of manufacture, but it is reasonable to expect that the average price throughout the year may improve following the pronouncement of the Government of a policy of maintaining the Colonial sugar industry; and the Commissioners further suggest that the amount of the preference be fixed subject to a limitation that the total price obtained for colonial sugar should not exceed the proposed fixed price of £15 per ton. They add that "if any arrangement ensuring a reasonable price to producers is established, sugar producers throughout the West Indies have expressed a confident expectation that those factories and estates which are at present below a reasonable level of efficiency would be able to obtain the necessary capital for improving their methods; and our observations, both of factories and of cultivation, have satisfied us that in many, probably in most, instances, this disposition and desire is entirely genuine and reliable."

Tate & Lyle New Issue.—Messrs. Tate & Lyle Ltd., lately placed on the market an issue of £1,250,000 5½ per cent. mortgage debenture stock at 97½, which was promptly over-subscribed. The issue was made to reduce bank loans incurred in the acquisition of the Fairrie sugar refinery at Liverpool and of the company's interest in four beet sugar factories.

The Mauritius Sugar Industry.

Report by Sir Francis Watts, K.C.M.G.

Simultaneously with the publication of the Report of the West Indian Sugar Commission, the Report on the Mauritius Sugar Industry prepared by Sir Francis Watts, K.C.M.G., has been issued by the Government.

Sir Francis Watts states that he has made careful and detailed enquiry concerning the conditions of the sugar industry of Mauritius, and as a result is satisfied that that industry, generally speaking, is carried on at a loss in existing circumstances, that is to say, when the price of sugar not exceeding 99° is around or below £13 per ton, f.o.b. Mauritius, and the preference at present granted to Empire sugar is maintained. An examination of the records covering over 57 per cent. of the crop of 1928-29 brings the conclusion that the cost of growing, manufacturing and putting on board ship of a ton of Mauritius sugar is, as near as can be calculated, £13. 1s. 2d. while the average selling price during 1929 has been about £12. 2s. 10d. per ton, f.o.b., so that, broadly speaking, the general loss to the industry might be put at 20s. per ton for the crop of 235,000 tons.

He is satisfied that the cultivation of the canes is carried on with a high degree of skill and efficiency, that much care is devoted to the cultivation of the soil and to the manuring of the crops, including the use of natural manures and chemical fertilizers. Consequently no changes or improvements in field methods are likely to be suggested as would substantially remedy the financial difficulties now experienced.

The factories are, for the most part, equipped with machinery of a fairly efficient character. A certain amount of the machinery is new, but in some instances it is old, and in a few cases calls for renewal, and this would be effected if the industry were working at a profit. Actually from 1921 to 1928 some £1,613,468 is stated to have been spent on imported machinery for agricultural purposes and for the manufacture of the sugar, irrespective of work done by local engineering firms, who latterly have made quite a large quantity of important machinery, including mills and engines, triples and quadruples, vacuum pans and juice heaters. There are doubtless several instances where amalgamation of factories, coupled with improvements of machinery, might be economically advantageous, but Sir Francis Watts can see no reason for advocating the erection of a few large central factories, and does not feel that their extensive adoption would afford any relief.

The work of the factories is generally excellent. The mill efficiency is usually good ; being in the best factory 95·3 per cent. and the average may be placed at about 94 ; the recovery of sugar from the expressed juice is fairly good on the whole, being in the best instances an average of 89½ per cent. of 98½° sugar during 1929. The cost of production of sugar in Mauritius is below that of all foreign countries except Java, and possibly Cuba.

Since, then, no improvement in the industry would enable it to pay its way in the face of the present abnormal depression of sugar prices, Sir Francis Watts urges the Imperial Government to make grants-in-aid to the colony calculated to make good the losses inevitably incurred. He suggests that a grant should be made in any one year equal to the loss that may reasonably be concluded to have been sustained in the previous year. The cost of production being in the neighbourhood of £13 per ton f.o.b., the grant-in-aid should be calculated as the difference between that figure and the average selling price actually obtained for the given crop. It is urged also that these grants should be continued for a period of not less than five years. In any event they are only sufficient to keep the industry afloat till better times arise.

The Situation in Cuba.

The Work of the Co-operative Export Agency.

By EARL L. SYMES.

The dry weather that gave the ratoons a poor start during the first five months of 1929 was followed by abundant rains during the remainder of the year. The normal rainfall for the seven months period from June to the end of December is 39·15 inches; in 1929 the corresponding total received was 39·96 inches as will be seen in the following table.

DRY AND WET SEASON RAINFALL IN CUBA.

Year.	1925	1926	1927	1928	1929	Normal
Five months, January to May	19·75	17·57	8·87	11·54	8·38	14·95
Seven months, June to December	32·50	43·30	36·76	34·76	39·96	39·15
Total for Year	52·25	60·87	45·63	46·30	48·34	54·10

The above figures are from the Cuba Sugar Club reports, as are also the following data showing monthly distribution during the past few years.

MONTHLY DISTRIBUTION OF RAINFALL IN CUBA.

Inches

Year.	Jan.	Feb.	Mar.	Apr.	May	June	Jul.	Aug.	Sept	Oct.	Nov.	Dec.	Total
1926	2·99	1·37	0·65	4 67	7·77	8 60	6·02	7 60	6·76	8 98	4·60	0 86	60·87
1927	0·95	0 78	0 59	1 52	5 09	4·22	5·91	5 23	7 24	12 12	1·58	0·40	45·63
1928	1·08	0·53	1·48	2·34	6·11	6·89	5·74	7·87	5·55	6·64	1·47	0·60	46·30
1929	1·26	0.46	0 86	2·49	3 40	9·09	4 39	7·45	7·24	7 59	1·44	2 67	48 34
Normal	1·94	1 49	2 04	2·75	6·73	8·08	5·16	5·68	7·65	6·80	3·70	2 08	54·10

From these data it will be observed that the past wet season was better than usual for the growing cane. Since the crop was stunted during the first part of the year, the tonnage expected this year is lower than that harvested during 1929.

Several estimates have been published as to the out-turn of the crop which was begun on January 15th this year, the same date as in 1928, but two weeks later than last year. The estimates issued are as follows :—

	Long Tons Spanish Weight.
By "Revista Azucarera de Cuba"	4,483,554
,, Cuban Dept. of Agriculture	4,545,000
,, Guma y Mejer (used by Willett & Gray)	4,628,354
,, *I.S.J.*, August, 1929, page 417	4,640,077

These all indicate a reduction of more than 10 per cent. over the crop of 5,156,410 tons of 1929. Further revisions will be made during March and April, and the indications are that these will be downward. Sugar is being made at a slower pace this year and this will be more noticeable as the crop nears the end.

One of the reasons for the slow production rate this crop is that many mills have been in the habit of shipping sugars almost as fast as made. The control of all export sugars by the Co-operative Export Agency (C.E A.) and the prevailing low prices have made it impossible for such mills to ship. As a result they have slowed up in order not to fill up their warehouse space too rapidly. Some new storehouses have been built on the plantations, but many are planning to stack their sugars in the yards adjacent to the factory when the warehouses are full. These piles will be given temporary shelter by tarpaulins, etc. It is also reported that there is a scarcity of ready money and that some mill owners are reduced to an exchange of sugar for their supplies. Several important newspapers in Havana have exaggerated these conditions and have begun a campaign against the C.E.A., asking for its dissolution.. On February 27th the executive committee of the C.E.A. issued a proclamation stating that they had the confidence of enough stockholders to maintain

the Agency in operation, and that the complaints made were susceptible of a harmonious solution, if properly presented and acted upon.[1]

This agitation has called out expressions of opinion frcm all sections of the Island and the majority seem to be in favour of sustaining the C.E.A., at least until the present crop has been marketed. It is probable that in the meantime the general public may be enlightened as to the real necessity for this co-operative effort and the benefits to be derived from it, if it is actively supported. The present defamatory campaign has provided the New York rumour mongers with good material and they have been busy. It probably had nothing to do with the final increase in the U.S. Tariff from \$1·76 to \$2·0 per 100 lbs. on Cuban raws.

The operations during the past six months of the C.E.A. have brought the Cuban producers more than three-quarters of a million dollars in improved prices obtained for their sugars than would otherwise have been secured. It was shown in our October article that the average warehouse price obtained for Cuban raw sugar up to August 31st, 1929, wa 1·67 cent per lb. Up to the end of February 1930 the C.E.A. has sold 393,188 tons of old crop sugars at an average f.o.b. price of 1·89 cent per lb. Allowing 0·13 cent for shipping expenses, the net price in warehouse would be 1·76 and this increase in price amounts to \$792,667 on the 393,188 tons sold, assuming that it would have brought 1·67 without control. This is unlikely since the price had fallen to 1·49 cent in June 1929 the month before the effect of the C.E.A. began to be noticed. It is too early to estimate the amount saved for the producers by the refusal of the C.E.A. to accept ruinous prices offered for new crop sugar in the past two months. Only 384,099 tons of new crop sugars had been sold to February 28th, 1930, at an average price of 1·626 cent f.o.b. Of this amount 106,810 tons had been shipped.

The position at the end of February is given in the following table :—

CUBAN PRODUCTION AND STOCKS AT END OF FEBRUARY.

	1927	1928	1929	1930
Yield	10·68..	11·23..	11·76..	11·59
Production	2,101,394..	1,872,919..	2,538,118..	1,737,366
Shipped, Tons	619,187..	386,382..	732,764..	106,810
Stocks	1,482,207..	1,486,537..	1,805,354..	1,630,556

The stock on hand included sugars that will be used for Cuban consumption. This shows that the supplies on hand were less than at the same time last year and only about 10 per cent. greater than in the two years previous. It is probable that more than half the production to the end of February last year had been sold before that date, so that the C.E.A. has sold about one million tons less to the same date this year. The producers should remember that every 0·1 cent increase in price means \$2·24 per ton and if obtainable through the efforts of the C.E.A. will amount to \$2,240,000 on this sugar that has not been thrown recklessly on the market. The best co-operation that they can give at the present time is to prevent the circulation of false rumours which can be used to depress prices.

Consideration of the probable position of the Cuban sugar industry at the end of 1930 will convince anyone that the dissolution of the C.E.A. at the present time would be disastrous. If the production should reach 4,500,000 long tons and the Cuban consumption take 150,000 tons there would be an

[1] Since this was written the news has come to hand that the stockholders have voted in favour of the retention of the C.E.A., the figures being 11,139 for the dissolution of the agency and 12,918 against.—ED. *I.S.J.*

exportable supply of 4,350,000 tons. It was possible to export to the United States 3,750,000 tons last year due to low prices and the desire on the part of speculators to store sugar for a rise in the Tariff. Since 3,014,595 tons refined or 3,240,688 tons raw value of Cuban sugar was included in the United States consumption of 5,810,980 tons during 1929, about 500,000 tons of the exports went into warehouse. This stored stock will probably enter consumption this year and if the Cuban proportion should equal that of 1929, the balance required from the present Cuban crop would be only 2,750,000 tons. This would leave some 1,600,000 tons to be marketed elsewhere by the C.E.A.

Cuban exports to world markets have never reached this high total before, and it is certain that if the sales were decontrolled at this time there would be a serious break in prices. A committee of the C.E.A. has been busy finding new markets for Cuban sugar and recent sales to Russia show that some success is being attained. At present market advices state that the C.E.A. is negotiating a sale of 500,000 tons to Russia. If this large amount can be successfully financed, the problem of Cuban world market sugars for the present crop would be solved, since the regular markets would be able to absorb the balance and prevent a heavy carry-over at the end of the year. The recent Tariff change in India may favour an exchange of sugar bags and Cuban sugar between these countries. The management of the C.E.A. seems to be alert and active and the Cuban producers should strive to co-operate and bring their problems before it in such a manner that they may receive due attention. Continued destructive criticism will only increase the Agency's difficulties and keep false rumours alive that upset the market and cause lower prices.

Mauritius.

Department of Agriculture Report for 1928.

The Annual Report of the Department of Agriculture of Mauritius for the year 1928, as prepared by Mr. D. D'EMMEREZ DE CHARMOY, the new Director of Agriculture, comes out later than usual this year. The Report was submitted on August 5th last, but unfortunately is published only in 1930, by which time the 1929 crop also is a more or less accomplished event.[1]

According to the Director, the preliminary compilation of factory results for the 1928 crop gave a total of 251,100 metric tons of sugar, which compares with 218,000 tons in 1927, 192,590 tons in 1926, and 241,220 tons in 1925. Field returns were largely of a high order, and owing to the favourable weather conditions experienced during the ripening season, the sucrose content of the cane was high and the recovery of sugar very satisfactory. Of the above-mentioned total, 77 per cent. is estimated to consist of vesou sugars, the balance being made up almost entirely of raws, owing to the changed English market conditions. This compares with 98·63 per cent. vesou in 1927, and a percentage of over 98 in the three previous seasons.

The average extraction of sugar per cent. of cane approximated to 10·7, which compares with 10·53 in 1927 and 9·94 in 1926, and an average of 10·41 during the last 10 years. The total number of factories at work was 43.

At the end of 1927 the area under cane cultivation was estimated at 157,700 acres, a decrease of 4,400 acres on the 1926 figure. Of these, planta-

[1] This delay in publishing these official reports is a feature of more recent years; the Report for 1924 appeared in our pages by September, 1925, and that of 1925, by November, 1926.—ED., *I.S.J.*

tions on estates approximated to 83,500 acres, the balance being made up by small planters, nearly all of whom were Indians.

The Sugar Planters Syndicate continued operations during 1928, controlling more than 80 per cent. of the sugar production. The average sale price per 50 kilos for 1927 was Rs. 9·61 net, while low products fetched Rs. 6·66 net. The distribution in Grades was : Extra Fine, 4·8 per cent. ; Grade A, 94·2 per cent. ; other grades, 1 per cent. For 1928 the final figures were not yet available, but the approximate average was Rs. 7·95 per 50 kilos, which is the lowest since 1913. As in previous years the bulk of the sugar went to the United Kingdom. The movement of sugar during the export year of 1927-28 was : Great Britain, 196,700 tons ; America, 12,500 tons ; other places, 1,100 tons.

Dealing with the technical work of his department, the Director of Agriculture writes :—

Pests and Diseases of the Sugar Cane.— A new centre of infection of *Phytalus Smithii* was detected in the neighbourhood of Cluny. In all probability, this infection has been caused accidentally by the transport of sugar canes to estates at a time when the insect is in the adult stage and can be transported from one place to another. The foci of infestation are steadily increasing and leave but little hope that the pest can be restricted in spite of the low rate at which it is spreading. If on one hand, new areas are being gradually infested, on the other it is encouraging to record that the pest is disappearing in nearly the same proportion on areas already infested, and that the damage caused by it is therefore not more alarming. It must be admitted, however, that the money which is being spent every year for the destruction of *Phytalus Smithii* is a heavy burden on the sugar industry ; for independently of the export duty of two cents per 100 kilos of sugar levied to defray the cost of the campaign of destruction and of the annual amount provided for by the Improvement and Development Fund, the expenditure incurred by planters to protect their crops when the degree of infestation necessitates the application of expensive methods should also be taken into consideration.

The persistent but vain efforts made until last year to restrict its extension have shown that the amount expended for this purpose would be more profitably used for the destruction of the insect in its larval state on a much larger scale. This method, which was put into force in 1928, resulted in the destruction of 70 millions of grubs in the district of Moka solely. Apart from the above, the application of insecticides, under the control of the officers of the Entomological Division, has been greatly extended and it may be stated that by these means, coupled with that of its natural enemy *Tiphia parallela*, the damage caused by this pest can easily be controlled without too heavy expense. There exist no stronger reasons now than in the past to anticipate that this insect will in future prove more harmful to the sugar industry.

The other sugar cane pests such as borers, locusts, aphis, scale insects as in previous years did not cause notable damage, though all of them were more or less active in various localities, but in no case, however, as to cause serious losses.

In 1927, the attention of planters was directed to the damage caused by Gummosis which was then thought to be the main cause of the supposed degenerescence of White Tanna, and also to the necessity of replacing that variety by new ones more resistant to this disease. On account of the proved value of this variety which possesses a remarkable range of qualities, systematic researches were undertaken and are still in progress in view of

determining practical means of controlling the spread of this disease which affects more or less all the varieties cultivated in Mauritius. In the course of these researches, the Phytopathological Service of the Department ascertained that what was considered previously as Gummosis only comprises as a matter of fact two distinct diseases, Gummosis and Leaf-scald, which in Mauritius as in many other countries had been considered as one. It has also been shown that White Tanna is susceptible of being affected by both diseases to the same extent. Leaf-scald is widespread over the island, and the losses caused by it are greater than those occasioned by Gummosis. It is hoped that practical advice will soon be given to planters so as to cope successfully with these two diseases. For this purpose, careful investigations relating to the following plants have been undertaken :—(1) Disinfection of cane cuttings with a view to reducing the rate of these diseases ; (2) Selection of healthy planting material for the establishment of nurseries free from diseases with a view to obtaining the required planting material for starting industrial plantations. These investigations are in progress in the Laboratory at Réduit and in varietal plots for the propagation of new varieties.

Investigations in relation to the Sugar Industry.—In view of carrying out the resolutions of the Sugar Conference of 1927 relative to the production of new varieties of canes and to the rapid propagation of those already raised, four experimental stations were established, of an extent of 10 acres each. These stations situated in the four most important sugar producing districts—Savanne (St. Aubin), Pamplemousses (Mon Rocher), Moka (Alma and Valetta), Flacq (Bonne Mère and Constance)—have for object the determination in a systematic way and within the shortest period of the respective value of imported and locally raised varieties cultivated up to now at Pamplemousses and Réduit. Careful investigations have proved that these varieties are susceptible of being grown on a large scale. Owing to weather and meteorological conditions which vary in Mauritius within wide limits according to altitude, it was important at first to determine from these new varieties those best suited for each locality, as those plots are treated in the same way as the other cane fields of the respective localities. The results obtained will enable a judicious selection of those under experiment.

For the same purpose and also to meet the increasing demand from planters a considerable number of cuttings of these different varieties have been sold to them for the establishment on the estates of nurseries where investigations can be carried out. It is hoped that these new arrangements will bring rapid progress from the point of view of utilization of varieties newly introduced and raised by the Department of Agriculture.

In order to create other new varieties on more scientific lines, Mr. A. DE SORNAY was sent to Coimbatore, India, for studying the modern technic in connexion with cane hybridization. A special experimental station has been provided for those investigations. It is noteworthy that the close intercourse between the Agricultural body and the Department becomes still closer every day and that planters generally realize the value of the researches undertaken to promote their interest.

New varieties were imported on three occasions from Java—the first included POJ 2878, the second POJ 2725. Two only of the cuttings received germinated and were placed in a greenhouse built for that purpose ; but for many reasons the plants obtained did not grow satisfactorily. The third consignment, received by the Anglo-Ceylon Company, contained several hundreds of cuttings which, as the former ones, were placed under observa-

tion in two quarantine greenhouses erected at the expense of the Sugar Industry Reserve Fund. The plants obtained from these cuttings are growing normally and, as far as can be ascertained, are free from diseases and will be handed over to the Company to be planted in the open air towards the end of 1929.

General conditions in relation to the Sugar Industry.—From an economic point of view conditions continued difficult during the year. The market for sugar was unsteady, with a distinct downward trend. As a result, strenuous efforts have been made with a view to further decreasing the cost of production. Unfortunately, many estates are still burdened with heavy interest on what remains to be paid of greatly exaggerated purchase prices. To cope with present difficulties, planters have applied for and received a loan of Rs. six millions repayable by a special export tax on sugar of Rs. 0·50 per hundred kilos. The special duty of Rs. 0·05 per 100 ks. levied since 1920 on all exported sugar was abolished by Ordinance 29 of 1928. The prevailing opinion in local agricultural circles is that the best way of putting the whole sugar industry on a sound basis would be by way of a large loan—Rs. 20 millions—with long terms and low interests, distributed in such a way that mortgages still burdening many estates could be cleared and replaced by loans at a low rate of interest. The Chamber of Agriculture supports the idea, which is now receiving the consideration of local authorities.

The Sugar Technologist reported as follows :—

Visits to Factories, Investigations, etc.—A new feature in the sugar industry of this Colony was the production of a certain amount of raw sugar for the British market (about 50 per cent. of the total output). At the request of their respective managers the Sugar Technologist visited several factories in connexion with that question. Advice was given, the important point being the production of a sugar polarizing not over 99 because of the Customs duties in England, and as near as possible to 99 because of the penalties imposed by the buyers. Another important point is the moisture of the sugar ; there is a relation between that element and the keeping qualities of the raw sugar. In several factories sugar dryers were installed with a view to reducing the moisture of the sugar to a minimum. The study of these sugars necessitated a great deal of analytical work.

The juice was particularly good all over the Island and the manufacture of sugar easy. Recovery was more satisfactory than usual.

Preliminary work was done by the Assistant Sugar Technologist for the control of the production of steam in factories.

The use of water-cooled crystallizers has generalized in almost every factory, with satisfactory results.

Contrôle Mutuel.—36 out of the 42 factories contributed to the *Contrôle Mutuel* and fortnightly returns were regularly distributed amongst contributors. As last year the names of a certain number of factories were given.

Educational.—Full courses of lectures were delivered by the Sugar Technologist and the Assistant Sugar Technologist to the second and third year students of the College of Agriculture in Sugar Technology, Sugar House Chemistry, Cultivation of the Sugar Cane, Mechanical Engineering, Building Construction and Surveying. Practical laboratory work was also performed as well as practice in mechanical engineering. The students visited sugar factories, engineering workshops, etc., with the Sugar Technologist and the Assistant Sugar Technologist.

"Sugar Cane and its Culture." [1]

The Work of the late F. S. Earle.

This volume of 350 pages is divided up in an unusual manner. The author opens with a very brief historical survey, to which must be added an Appendix in which he summarizes the present position of the sugar industry in the more important producing countries, altogether covering 26 pages. He then at once proceeds to give his experience of the sugar cane and its varieties, in 100 pages ; to which must again be added another Appendix, a reprint of his well known Annotated List, in 80 pages of smaller print. Then follows a section on pests and diseases, covering 80 pages ; and the volume concludes with 60 pages on cultivation, including a short chapter on climate and soils.

This, at first sight, appears to be a very arbitrary distribution of his subject matter ; and we confess to some disappointment at the shortness of the first and last sections. But the number of pages devoted to each does not, of necessity, indicate EARLE's idea of its relative importance ; and a perusal reveals the underlying principle of the book, as stated in the preface : "Frankly, the atmosphere of the book is that of the cane field rather than that of the research laboratory." The longer sections have a good deal of accessory literary matter in them ; the shortness of the section on cultivation is, furthermore, partly explained by the fact that EARLE restricts his remarks to his own experience, and also because the "atmosphere of the field" permeates the sections on cane varieties and pests and diseases.

With his independent outlook, it was not in the author to copy the descriptions of other workers in the field, and the book "was written far from libraries and laboratories." Then EARLE, as a practical cane planter, does not as a rule describe any practice that he has not carried out himself, but confines himself to those "thoroughly tested in the field, and most of them on an extensive scale, and proved to be perfectly practical and workable."

The discussions on cane varieties come into an entirely different category. Based on the extensive collections in Porto Rico (and in Cuba ?), the author has gradually extended his studies in all directions to make his list as complete as possible. For this is a matter for the whole cane industry, and especially so, because of the great and increasing confusion which was found in the nomenclature. The result of these studies is seen in the Annotated List, while the canes described in the body of the work have, wherever possible, been grown by himself, with careful descriptions on the spot, drawn up on the lines of modern morphological knowledge of the sugar cane.

Lastly, pests and diseases must sooner or later go to the laboratory, and, as there is no part of the plantation work that has a more voluminous literature, our author has had to go there too and work in their libraries. This section, with the Annotated List, is more of a compilation than any other portion of the book, but that does not mean that EARLE's own observations are lacking or uninteresting.

Having thus prepared the ground, we are in a position to study the different sections more closely and profitably. The opening historical chapter begins with the wanderings of the cane plant from east to west, culminating in the dominance of the Otaheite variety, and later its disappearance from most countries in a series of epidemics ; fortunately coinciding with the discovery of the fertility of the seed of the sugarcane. Then he traces the gradual improvement in cultivation and in transport, and gives useful pictures of three modern harvesters, the HADLEY, LUCE, and FALKINER, which how-

1 Sugar Cane and its Culture. F. S. EARLE. New York, John Wiley & Sons, Inc. ; London, Chapman & Hall, Ltd. 1928. Price 22s. 6d. net. Circumstances have prevented the writer of this review from being able to read this work before ; and the book is not one either to read rapidly, or to review without having properly studied.

ever, to the untutored eye, give the impression of ill-arranged and intricate mechanism.

Under the heading Propagation of Sugar Cane, the author writes an interesting chapter on seedling canes ; and follows this with one on the Botany of the Cane, which however, only deals with the classification and external characters. This chapter commences with a translation of JESWIET's recent summary classification of the genus Saccharum ; and then proceeds to an analysis of the distinguishing characters of the individual cane varieties, as worked out by BARBER. Somewhat characteristically, he merely mentions the further development by JESWIET, who uses distribution of the minute hairs on the buds as a leading character in diagnosis, one would suggest because he found it inconvenient for field studies, and regarded it as a laboratory method.

Then comes his own lengthy chapter on the Varieties of Sugar Cane. He deplores the lost opportunities of describing the older canes in the great collections of varieties : "At one time the Java cane experimental stations had between four and five hundred named varieties in their collections, but we have no knowledge of most of them beyond a list of their names and the countries from which they came." And he records the places where other large collections were situated with a like result. STUBBS and ECKART did some work in unravelling the duplicate names of different canes; "it is, however, to the observations of NOEL DEERR that we owe most of our present scanty knowledge of cane variety synonymy."

The older descriptions of cane varieties were sometimes well drawn, but were for the most part merely vague notes on colour or habit of growth, which are of little value. The more recent morphological studies, however, have been sufficiently accurate for the author to draw up his descriptions. "With the key which accompanies them, it is hoped that they may be recognised as readily as are any of the species in large, closely related groups of wild plants." This key is a quite remarkable performance, and both it and the detailed descriptions which follow bear evidence that EARLE grew most of the varieties himself ; and has studied their agricultural suitabilities as well as their botanical characters.

The key starts with the old time Creole and Negrita canes, "clearly related but of somewhat uncertain botanical affinity." Next comes the important group of the *Saccharum sinense* "or Chinese canes (Pansahi of BARBER)"; he then passes to the half-bred *S. spontaneum* canes, and the *S. Barberi* hybrids or North Indian group ; thus coming finally to the noble canes and the hybrids with a large proportion of this blood. He only treats of the more important commercial canes.

The descriptions of the individual canes dealt with are models of method, commencing with the origin and history of the variety as far as is known, and after this, the botanical description according to a uniform plan. The susceptibility to disease follows, and general remarks as to preferences in the local climate and in the soils of Cuba and Porto Rico—that is in the adopted country of the author for twenty years.

Taking as example one of the shorter descriptions, and leaving out the botanical part, we have the following for B 3922. "A seedling from B 647. Until the mosaic outbreak it was planted largely on the south side of Porto Rico in the irrigated district. Being very susceptible to that disease, it practically went out of cultivation. Now that mosaic is more or less under control there, it is again being planted. It is one of the few of the older varieties that is competing with BH 10 (12) and SC 12 (4) . . . (Botanical description) . . .

On suitable lands this is a high tonnage cane. It is later than Crystalina but at full maturity gives equally good sucrose. It has not been tested widely enough fully to determine its soil requirements, but it will probably give best results on rather moist, black lands. It ratoons well and seems fairly resistant to root disease. As previously stated, it is susceptible to mosaic and should only be planted where this disease is being controlled." The 86 varieties cover 66 pages of the book, and the author's remarks about them are well worthy of study.

The Annotated List in the Appendix was first published in the *Journal of the Department of Agriculture in Porto Rico,* Vol. 4, No. 3, dated as of July, 1920, but not issued till April, 1921. It is a notable performance, and shows EARLE in a new light, namely as a close student of such literature as was available in Porto Rico, with the result that some 1500 names and synonyms are run down and tabulated : as in the list of commercial canes these names are arranged in alphabetical order. To give an idea of the various information contained in the list a few paragraphs are quoted, namely, " B . . Badouka."

It is expressly stated that no attempt has been made to list the innumerable seedlings, " but the initials under which they are enumerated have been listed so far as it has been possible to ascertain them."

B.—(As an initial with numbers) = Barbados seedlings. The long list of seedlings produced by BOVELL in Barbados, some of which are extensively cultivated in all parts of the world. A second series of *B* numbers seems to have been started (See Rept. 1915-17 ; 62, 1917). *B* following a number indicates a seedling produced in Java by Bouricius.

Ba.—(As an abbreviation with numbers) = another series of Barbados seedlings. (See Rept. 1907-9 ; 46, 1910). No explanation of this series has been found. The numbers run into several thousands.

Badila.—(Also spelled Badilla) Queensland, from New Guinea as No. 15, 1896, Maxwell, Easterby, Barbados Rept. 1911 ; Trinidad, Williams, Bull. 18 : 72 , 1919 (des). The leading commercial cane of Australia and Fiji. Adapted to low heavy lands.

Badouka.—Cent. India, WATT's Dict. 6 (2) ; 69, 1893.

The eighty pages devoted to Diseases and Pests of the Sugar Cane show a somewhat rigid selection, especially with the insects, both as to the names to be included and the relative fullness of discussion. About thirty are enumerated in each case, many of them composite, and the author's remarks often show an intimate personal knowledge of the organisms concerned, the conditions of their occurrence and their effects on the sugar cane crop.

In treating of diseases, the author clearly states his view that " So far, no practicable remedy has been discovered for any of the principal cane diseases, using this term in its usually accepted sense as being a spray or other topical application." The sugar cane is not a crop that lends itself to such treatment which, moreover, would be highly uneconomic even if effective, because of the great size of the plant and the immense bulk of the crop.. The author tends rather to the selection of resistant varieties and the general aim at ensuring a healthy growing environment.

He compares the way in which the species of Saccharum at present described react against disease, and continues the comparison throughout the chapter under the different diseases. He states, however, that " all commercially grown cane varieties are descended from one or another of four species of Saccharum. These are *S. officinarum,* or the so-called noble or tropical canes ; *S. sinense,* the Chinese or Japanese canes ; *S. Barberi,* the North Indian canes ; and *S. spontaneum,* the wild canes." This generalization is, to a certain extent misleading, at any rate with respect to the North Indian

cane varieties, which are beginning to loom so large in all discussions of seedlings and disease.[1]

Earle emphasizes the view that, for fighting disease in sugar canes, we must look rather to the plant breeder than to the pathologist. "The commercial canes of the future will quite certainly be hybrids combining the blood of two or more, probably three, of the above races, thus giving us the high sugar content and good milling qualities of the noble canes together with the hardiness, high tonnage, long ratooning, and disease resistance of the other races. The cane breeders of Java and India are already showing the way."

The enumeration and description of cane diseases appropriately open with two essays, on mosaic and root disease respectively ; two diseases on which a great flood of literature has been poured out in recent years. The ten pages devoted to each, with the additional couple of pages with the titles of their most important papers, are excellent examples of the treatment of such difficult subjects ; with, as usual, a keen eye to the practical side of the question. Earle contrasts the two diseases as follows : "In mosaic we are dealing with a clear cut disease caused by a specific parasite or virus which, as far as we know, occurs in nature only within the tissues of living plants and which can be transferred from one plant to another through the agency of sucking insects. Clearly, control rests in destroying infected plants and thus avoiding sources of contagion. The particles are so small that they cannot be detected by the most powerful microscopes. When we cannot see a parasite we have to imagine one." "In root disease, however, we are dealing with the combined actions of various unfavourable environmental factors which so lower the vigour of the cane plant as to permit of the attack of some one of several weak facultative parasites that are everywhere present in cultivated soils. Both factors are necessary to induce the disease. The fungi are unable to attack plants that are full of vigour. The unfavourable environmental factors alone, while they would reduce yields, could not induce root disease without the aid of the facultative parasites."

The study of mosaic and root disease has proved in both cases to be extraordinarily difficult, in the latter because of the indefiniteness of the causal agent and in the former because of its invisibility and doubts as to its existence. The historical summaries by the author, of the different phases of opinion, are complete in all essentials. Both of them were found in the Java cane fields, once the new plantation research was set going in the eighties and nineties. But while root disease has continued to receive (somewhat spasmodic) attention ever since, mosaic was obscured by various leaf markings in most other countries, and the Java work was overlooked. And when at length the disease become sufficiently destructive to demand attention (especially in the New World), it emerged from this obscurity only for it to be found with startling rapidity to be spread over the cane tracts of the whole world.

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[1] The two species recently founded by Jeswiet, *S. sinense* and *S. Barberi*, are based upon two of the North Indian canes, belonging to the Saretha and Pansahi groups ; and these groups are of very different standing as botanical units. The canes in the Pansahi group have well marked characters and are easily separable from the other Indian canes ; but they are so like one another that it is sometimes very difficult to separate them without careful study, if at all. From this it would appear that the group may be of comparatively recent origin. The Saretha group, of which only one or two forms have been selected as types of the species *Barberi*, consists on the other hand of numerous widely differing forms, readily distinguishable among themselves, but with a number of fundamental characters in common. And this group, moreover, exhibits traces of alliances with other groups or isolated forms, which would rather point to a much more ancient origin. There are also other North Indian groups of cane, which have been separated out of the welter of forms, and which are as distinct, if not more so, in their botanical characters as the Pansahi and Saretha groups ; such are the Mungo and Nargori groups, which happen to have certain very desirable characters as parents, but are nearly or altogether infertile. These, and yet other North Indian canes not yet clearly described, await the attention of the trained systematic botanist. *Saccharum Barberi* does not therefore stand for the North Indian canes, and *Saccharum sinense* is a North Indian cane which has, within historical times, strayed into China from India. C.A.B.

The descriptions of these diseases, and the discussions of their treatment are adequate, considering the few pages allotted to them.

The study of insect pests is of course very different. To demonstrate the presence of an injurious fungus requires microscopic examination in the laboratory, the running down of the species depending often on the complicated technique of cultural methods. This study is from first to last the work of specialists, until they can put the full tale before the plantation workers, who then have to work out the remedies under the guidance of the pathologist. The presence of injurious insects is at once patent to the field worker, but he is unconcerned till the increase in numbers is so great as to cause a distinct diminution in his crop. Then the specialist is called in to name the insect, trace its life history, and note the periods when it is assailable; also to find out if it has enemies and, if these are not present in the fields, to try and procure them from elsewhere.

This introduction of insect enemies is the line which has produced the best results in the cane fields, and EARLE lays great stress upon it. "As is the case with cane diseases, there are none of the prinicpal cane pests that are held in check by special remedies or topical applications. . . The only spectacular successes that have been achieved in insect control have come from the importation of insect parasites which have attacked the troublesome species and so reduced their numbers that their injury has become negligible." The arrangement of the pests described in this chapter is one which has been found most convenient in practical as contrasted with scientific treatises, namely according to the part of cane plant attacked: stalk, leaf, root, with their borers and sucking insects, weevils and white grubs, and sucking insects and chewers respectively.

But many will, no doubt, turn with greatest interest to the last section of the book, that dealing with the Cultivation of the Cane. And they may at first be disappointed to find that EARLE deals chiefly with Cuban conditions, practice and soils, with some reference to Porto Rico and Louisiana. But a further study will reveal that this is the reverse of a drawback, because of the very varying conditions which he describes—with an authority which cannot be questioned. The author is on sure ground, and his analysis of the good and bad in the local practice, and the very definite suggestions as to what should be done with the different soils under differing climatic conditions, will prove of advantage to anyone engaged in plantation work on sugar estates.

In an introductory paragraph, he lays down a principle with regard to improvements. "The view seems to be widely held that crude methods are cheap, and that improved methods are necessarily more expensive. This may be true in part if we only look at costs per acre; but no method can be considered an improvement that does not lead to cheaper costs per ton of cane or, better, per pound of sugar. That is the central underlying thought around which this book is written."

A short preliminary chapter is inserted on climate and soil. In discussing rainfall, he considers that for growing sugar cane it should be at least 50 inches in the year. This is based on his experience in Cuba, and that is the general average of the island. But he lays stress on two points. In the first place the growing of sugar cane, in tropical regions, is better where there are alternating wet and dry periods, than in one where the rainfall is equally distributed throughout the year (of course the extremes of the wet and dry periods experienced in the Old World are not included in this generalization). The wet period pushes on the growth of the cane, and the dry period is needed for ripening and harvesting. Cuba appears to suit these conditions to per-

fection, and this accounts to a large degree for the extent to which the cane is grown there : "March to October is the rainy period and the rest of the year is dry." In the second place, where the rainfall is scanty and there is no irrigation, "production costs could be decidedly lowered by going to the expense of providing water for a few irrigations at critical periods, simply as a supplement to the natural rainfall." As to the much discussed question regarding the maximum quantity which can be profitably used for the cane crop, EARLE gives it as his opinion that 100 inches a year, if properly distributed, will usually give as good or better results than any larger quantity.

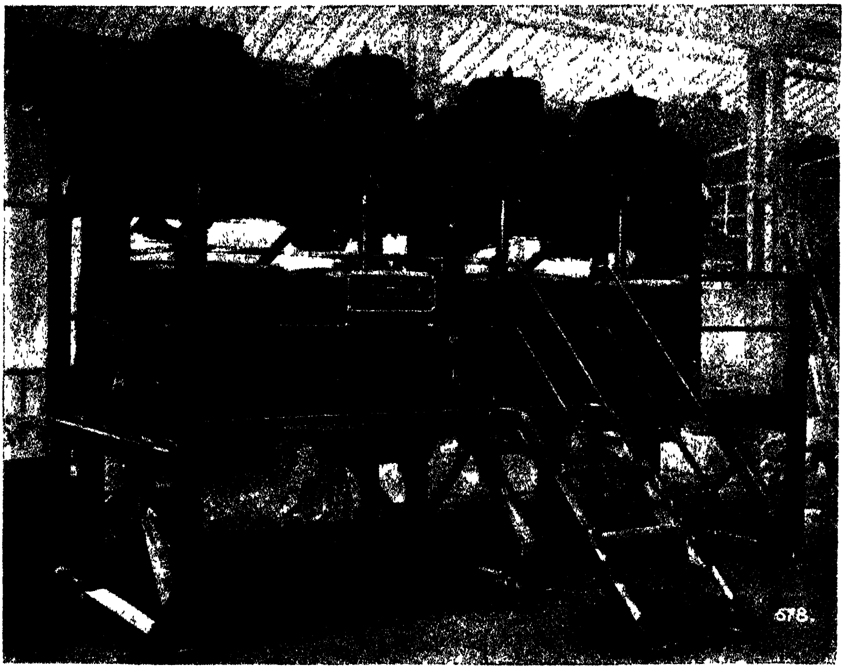
The introduction of Louisiana opens the question of extra-tropical cane growing, and he discusses in some detail the makeshift windrowing practised there. After summing up the effects of frosts on the cane, he concludes as follows : "The worst drawback, however, in these climates is that all the crop has to be made on immature cane. In Louisiana, 8 or 9 per cent. of sugar on the weight of cane is considered a good yield, while in Cuba, with mature cane, the average yield is over 11 per cent. and sometimes reaches 13 per cent."

The actual work in the fields is too detailed to be described.[1] There are two chapters, Preparation for Planting and Systems of Planting, the latter being much the longer. In Preparation for Planting he first describes the methods used in opening up new land, which in Cuba will not permit the use of mechanical implements as the stumps are left in the ground to a large extent. There is thus really no preparation of the land until the long period of ratooning is over, justly described as the period of exploitation as contrasted with cultivation; for the fertility of the soil is gradually dissipated during this period. EARLE appears to be somewhat undecided on this procedure : "It is perhaps an open question if in the long run it would not be better and cheaper to dig the stumps and properly prepare the land in the first place, but as a matter of fact this is seldom or never done for cane planting."

Preparing the land is then discussed in the dry and wet periods of the year. And then the various implements used are compared, starting with the walking plough, and proceeding to FOWLER's steam plough and the new STOREY's plough in succession. The last named appears to be a revolutionary implement, and obviously holds the attention of the author. Comparisons are made between it and the steam plough, and then it is described in some detail. It is truly a wonder implement ; and such is its power and ease of manipulation that the soil can be reduced to fine tilth to any depth in a broad strip, ten feet wide at one passing. Various ploughs and harrows may be attached to it behind, and even furrowing ploughs, so that planting may be done right behind it as it travels, effecting a great saving in time. Good pictures are given of it. It was devised by N. C. STOREY, of Porto Rico, who was in charge of a team of seven steam ploughing outfits, and "it was devised to overcome some of the inconveniences encountered in their use." The treatment of grasses with underground creeping stems, such as Para and Bermuda, completes this important chapter.

The rest of plantation work, usually termed cultivation, is discussed in the chapter entitled Systems of Cane Planting, which is some 50 pages long. The systems described are the Cuban, Porto Rican or grand bank, Louisiana and Hawaiian. For the Cuban, EARLE picks out four implements as a simple outfit suitable and sufficient for either plant or ratoon fields. First and most important of all comes a 14-tooth harrow-cultivator, with very narrow cultivator blades with the tips bent forward ; very useful for maintaining the dust

[1] It is hoped by the writer that an opportunity may occur, at some future date, for discussing in more detail EARLE's methods and conclusions.



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mulch in dry weather. Then a three-shovel cultivator with big 6 to 8 in. shovels : heavy and often needing two animals ; and for use during rainy weather or when the grass is too big for the harrow cultivator : very often the best results are obtained by using this implement and the harrow-cultivator alternately, the shovel cultivator being rather a weed killer than a dust mulch maker. A small 8 in. turning plough is an emergency implement without any place in ordinary cultivation. But it is needed when in protracted rains the weeds get beyond the cultivators, and is then used for turning the weeds under. The last in the series is a small, reversible disc harrow with only three discs in each gang, thus being narrow enough for running between the rows of canes. It also is an emergency implement, but is invaluable when the weather turns suddenly dry, after heavy rains, and it is impossible to get the cultivators round fast enough to avoid crusting. After its use the dust mulch can easily be regained, whereas the tooth cultivators leave large fragments which are slow in working down. It also does excellent work in covering seed cane in the furrow, doing the work of 20 men, and equally well if the ground has been properly prepared. The author concludes this list with the remark that although it could be endlessly extended, "with these four implements alone perfectly satisfactory cultivation can be maintained in both plant and ratoon fields."

These are all implements drawn by animals, and horses or mules are far to be preferred to country oxen. Tractors are coming in and increasing, but work with them is at present in the experimental stage, "none of the rigs in the market being fully adapted for the purpose."

Separate short sections, devoted to ratoon cultivation, drainage, irrigation, fertilizers, tillage, roadways and fireguards, harvesting, and agricultural policy, conclude section and volume. The two Appendices follow, and an eight-page list of the more important references.

C. A. B.

Tropical Agriculture."

The second edition[1] of NICHOLLS' "Tropical Agriculture" originally written forty years ago must have been very difficult to prepare, and certainly it is so to review. This well known work had the modest aim of furnishing a textbook for schools in the West Indies ; and it is no small achievement of the author that it has appealed to so much wider a circle ; and that no fewer than four reprints were made in the years immediately before and after the war. It has, in some sort, become a classic, owing not only to its lucid style but to the intimate knowledge of the plants dealt with and the scientific training of the author. But the retention of the old title, perfectly justifiable in the original, is apt to be misleading at the present day. The distribution of tropical plants of economic importance received a fresh impetus in Dr. NICHOLLS' day, because of the activity of the Royal Botanic Gardens at Kew ; and he remained in close touch with this institution all his life, and grew many of the plants received from it. The term "tropical agriculture" thus gradually assumed a narrow sense ; for the crops dealt with in the book were chiefly those grown in the West Indies by European planters, afterwards referred to as "planters' products." To-day, tropical agriculture has a much wider significance, and to write a textbook on it is hardly within the capacity of one author : it would take a life time to prepare, and when it at last was ready for printing would inevitably be already out of date.

[1] A Textbook of Tropical Agriculture, by Sir Henry Alford Nicholls, revised by John Henry Holland. 1929. (Macmillan & Co. London, W.C.). 15s. net.

Having thus cleared the ground of the first natural criticism, we can turn to a comparison of the two editions : it is necessary to do so, because the number of pages has been doubled. The author of this edition has set himself the laudable but somewhat hazardous task of retaining, wherever possible, the original wording, a matter of considerable difficulty in a forty-year-old book : it at once reminds one of "pouring new wine into old wine skins." But a careful study shows that the risks involved have not been great, for there is astonishingly little of the "new wine." The interpolations in the original text are neither numerous nor lengthy, and the author appears to have exercised great ingenuity in arranging that page after page of the first edition is simply reprinted. The extra paging is largely due to the addition of a great number of new and useful illustrations. Then at the end of each chapter a fairly generous literature which is of considerable value is added. But the most important addition is at the end, where there are some 150 pages of new matter, on Fodder Crops, Fibres, including cotton, Rubber, and Oil Plants, both fixed and volatile.

It is not our intention to say anything which might detract from the value of Dr. NICHOLLS' book, which has fully justified itself through a long series of barren years. But in the second edition it might perhaps have been of advantage if Part I had been re-written. This treats of the elements of agriculture, not in the tropics but in temperate regions ; and with the altered public for whom the book is intended, a fine opportunity has, we think, been missed, of giving a short account of the peculiarities of the conditions of agriculture in the tropics as compared, say, with those in Great Britain. Again, even allowing for the somewhat close adherence to planters' products, we see that rice has been included in the chapter on Tropical Cereals. That being the case, the millets merit something more than the two pages of print allotted to their general treatment. As rice is the wet land cereal in the tropics of the Old World, millets are its counterpart on the dry land ; and there must be well over 100,000,000 acres covered by this crop. The only interpolation is a recent classification of Sorghum.

Lastly, the following note has been received from a friend in respect of the references to sugar machinery (with which the writer is in full agreement) : "It is unfortunate that the author in the section on Sugar did not confine himself to the agricultural side instead of making an incursion into the manufacturing one, for here he has perpetrated descriptions appertaining to the methods of fifty years ago and these do not, as he suggests in a modern interpolation, 'apply in no small measure to the present time.' The only sugar mill illustrated is a pre-historic specimen for animal power. This lack of up-to-dateness is all the more surprising when we find that the author has had access to NOEL DEERR's standard work, from which he could readily have summarized the modern process of sugar making."

This is, in fact, one of the numerous suggestions scattered through the book that the author of the present edition has not had the advantage of that personal practical experience which was so marked a characteristic of NICHOLLS' book. For the rest, the value of the original work has undoubtedly been considerably enhanced by the additions already referred to ; and the present edition will serve as a useful introduction for beginners into one great branch of agriculture in the tropics, usually spoken of as Economic Botany. Bearing in mind the vastness of the subject, it is a notable piece of work ; but it would, we think, have been of advantage to indicate the limitations of the volume in the title.

C. A. B.

Third Congress of the International Society of Cane Sugar Technologists.

Abstracts of Papers read before Section D (Factory Operation and Chemical Control.)[1]

A Study of Milling and Hot Maceration of the Bagasse.

Dr. V. KHAINOVSKY.

As soon as bagasse emerges from the rear opening of the mill, the walls of all broken cells that were flattened between the rollers return almost to their original shape as the result of the natural elasticity of the fibre. When the broken cells get rid of the greater part of their contents, they suck in the surrounding air, resuming their shape. Maceration liquid on coming into contact with the bagasse, should penetrate as far as possible, a thorough mixing with the remaining juice in the bagasse being effected. But this never completely happens. In the first place, all the cells are not broken, and consequently they are not all accessible for maceration ; and in the second place the great majority of the broken cells are already filled with air, the juice being found only in the interstices between the surfaces of the air bubbles and the cell walls. Under these circumstances, a long time is necessary for the diffusion and admixture of the maceration liquid with the remaining juice in the bagasse. However, though it has been found that the presence of air in bagasse hinders maceration, the observations made have led to a new system of milling control,[2] and the application of a new method of hot maceration.

As soon as the presence of living cells in bagasse was demonstrated, experiments on a large scale were carried out by the Java Experiment Station on the hot maceration of bagasse. Specially constructed arrangements in which the bagasse underwent an intensive lixiviation with hot water or juice were used, and the Nobel hot maceration system seems to be the most efficient of these. It consists of the treatment of the bagasse between two consecutive mills in counter-current several times with hot maceration liquids in an almost closed and specially constructed carrier. Before the rear mill, hot water or the most dilute juice is squirted on the thick layer of bagasse. This layer is brought about by making the maceration carrier run several times more slowly than the ordinary carrier ; the maceration liquid permeates the bagasse layer, flows underneath, and is received into a gutter under the carrier. All the juice that has passed the bagasse layer is warmed by means of steam jets or in preheaters and is pumped in its entirety into the maceration carrier upon the next part of the bagasse layer.

This process of percolation is repeated several times. The increasingly concentrated juice finally accumulates in the lowest gutter under the maceration carrier, and is later used as maceration liquid before the front mill. There are several such equipments in use in Java, and generally the results are favourable. The working of the mills, however, is much influenced by the alteration of the properties of bagasse, which becomes very wet and hot. Not only is a feeding roll necessary to get rid of the excess of water but the setting of the mill adapted for the milling of a cold macerated bagasse is not suitable for material which has passed a hot maceration carrier. As soon, however, as the optimum mill settings are ascertained, the capacity will rise to the normal level of the factory. Then the maceration bagasse is much drier,

[1] Original Papers published in the *Proceedings of the Third Congress of the International Society of Sugar Cane Technologists*, published by the Executive Committee, price 12·50 guilders.

[2] See *I.S.J.*, 1929, 265.

and contains less normal juice. A serious drawback of the Nobel hot maceration system is a high steam consumption, which in the experiments carried out by the E.S. attained about 6·3 per cent. of the weight of cane, or 10 per cent. of the total steam consumption of the factory.

DISCUSSION.

Dr. KHAINOVSKY replying to Mr. WESTLEY stated that a distance of at least 8 metres is required for inserting a maceration carrier between two mills. Dr. HONIG, replying to Mr. SCOTT'S question as to whether lack of distance can be compensated by slowing down the speed of the carrier and increasing the thickness of the layer said that the thickness is determined by the permeability of the bagasse and at the utmost can be about 1 metre. Prof. VON PRITZELWITZ VAN DER HORST, replying to Mr. BAISSAC, remarked that he did not think that the use of two maceration carriers would pay. Besides hot maceration tends to diminish the capacity, and the rollers are liable to become smooth, at least until the correct settings have been found. Dr. KHAINOVSKY, replying to Mr. BENNETT, as to temperature required, said that the juice was heated to 80-90°C., though it was very probable that all living cells are killed at about 69°C.

Preparation of Cane and Grooving.

W. L. McCLEERY.

Knives.—Of the 39 factories in Hawaii, all but six use knives, 25 employing one set, and eight two sets. Three objects are in view: first, an even feed for eliminating chokes; second, a finer division, so that in non-shredder installations the blanket will absorb the maceration better, and as early as possible in the train; and third, an increase of capacity through better feeding characteristics. When one set is in use, it is always at the upper end of the carrier, located either near the head, or preferably slightly beyond with the tips about in line with the surface of the carrier slats. In most recent years the tendency has been towards the latter location, as better levelling is accomplished. The optimum speed is about 500 revs. per min. In non-shredder factories the distance between knives is usually 2½ in., sometimes less; but in shredder installations the spacing is from 2½ in. to 7 in. and the clearance 15 to 18 in. The lower knives located near the bottom of the carrier are used as levellers; their speed is 400-600 revs., the tips clearing the carrier from 14 to 18 in., the distance between them being 1 to 6 in. In the only factory with a shredder and two sets of knives, the distance is 9⅜ in. with 24 in. clearance. Power consumption in factories with one set of knives followed by a crusher and shredder has been found to be considerably less than 1 h.p. per ton cane hour, but due to incidential fluctuations motor sizes of 1·25 to 1·5 h.p. per ton cane hour are used.

Shredders.—There are 11 factories in Hawaii using the Searby shredder, which is giving very good service and is seldom injured by "tramp iron." In all plants but one a crusher precedes the shredder. The usual installation consists of one set of knives at the top of the carrier, a 2-roller crusher, and the shredder, the length of which can be less than that of the succeeding rollers. A difference of 6 in. is about the usual figure, though there are variations from 0 to 18 in. and even 24 in. Tests have shown that the power consumption is about 2 h.p. per ton cane hour, but to allow for momentary surges the motor sizes are figured at about 3·75 h.p. Six bars in addition to the anvil bar set with ⅛ in. clearance at the top and gradually increased to

¾ in. at the bottom is recommended for satisfactory quality of work and economy of power. As to the work that can be expected of the Searby, installed after a 2-roller crusher, tests have indicated an increase up to 20 per cent. in grinding rate without lowering the extraction ; or if the same rate is maintained there is an expected increase in extraction of 2·5, 1·25, or 0·8 per cent. respectively with 9, 12, or 15 roller tandems.

Crushers.—All but two Hawaiian factories have crushers, there being 22 with the Krajewski type and six with the Fulton ; also nine factories have 3-roller crushers which in reality are coarse-grooved 3-roller crushers, Krajewskis run 33 ft. per min. with the mills at 21 ft. ; and Fultons at 30 ft. with the first mills at 24 ft. Two-roller crushers to feed well can carry only 40-50 tons hydraulic pressure per ft. length of roller, compared with 60-80 tons on succeeding units. Three-roller crushers are doing very good work ; the grooving is about 60° and 1½ in. pitch. Their hydraulic pressure is 75 to 80 tons and surface speed 21 ft. per min., or about the same as in the succeeding mills. They are usually preceded by at least one set of closely set knives, giving a total mill extraction of from 97·5 to 98·7 per cent. of the sugar in cane, about the same as for shredder installations, though the grinding rates are lower. Last year their grinding rate was 1·97 tonnage ratio, or 26·5 tonnage fibre ratio.

Grooving.—Grooving practice varies greatly in Hawaii, due to equipment, rate of grinding, character of fibre, etc., etc. Except in 3-roller crusher installations, ¾ in. grooving of about 60° angle is commonly used in feed rollers, and is carried back as far as the 3rd and 4th mills with top and discharge spacing varying from ⅜ in. to 6 or 7 grooves per inch. The 3-roller crusher in grooving is usually 1½ in. pitch with from 4 to 7 grooves per inch in succeeding units. The use of Messchaert juice grooves cut in all bottom rollers has become universal in Hawaii. They are spaced 2 to 3 in. and from 1½ in. to 2 in. deep ; 2 to 2½ in. spacing being about the optimum, and they need to be at least 1¼ in. deep for proper juice drainage. Their width enlarges with wear from the scrapers, but ¼ in. for feed rollers and ⅛ in. for the discharge provide sufficient drainage. It is most essential they be kept clean. Juices grooves have increased capacity from 15 to 20 per cent. and extra tion up to 2 per cent. Water in final bagasse has been reduced about 5 per cent.

DISCUSSION.

Mr. BAISSAC, Mr. PERK, Dr. GIBSON and Mr. DEL VALLE all spoke of the favourable results of cane knives in increasing capacity. Mr. BENNETT said that in Queensland the extended use of knives will result in the elimination of the " National " shredder, which is responsible for mu h lost tim , beside being costly in upkeep. Mr. KUSAKADO described the special knife invented by Utida, in which " while cane is cut with one side of the blade, the other side of the blade is always being sharpened by the piece of cane which is cut," the knife being readily reversible. Discussing shredders and crushers, Mr. SCOTT said that in a factory in Trinidad there are two Searby shr dders, one following a Krajewski and the other a crusher with splitter rolls. There is less juice spray from the latter owing to drier material obtained from the grooved crusher rolls. Another Trinidad factory recently installed a Searby shredder with an 11-roller mill, increasing the pol. extraction by 2½ to 3 per cent., and the capacity about 15 to 20 per cent. Dr. GIBSON stated that his experience showed the " National " to be good, but the Searby shredder better.

Besides, the latter is less likely to be injured by tramp iron. He confirmed the figure of 15 to 20 per cent. for the increase in capacity without loss of ex-

traction. Discussing grooving, Mr. MESSCHAERT explained that his roller was introduced primarily as a feed roller to increase the capacity; and he believed that if Messchaert grooves were applied in Java in the same manner as in Hawaii better results would be obtained. Mr. BAISSAC confirmed the good experience in Mauritius with Messchaert grooves, it having been found that the water in the bagasse was reduced 4 to 6 units and the capacity of the tandems increased. Most mills there had these grooves on the feed and bagasse rollers. Mr. WESTLEY stated that it would not be possible in the P.I. to put the tonnage through without the Messchaert grooves; and Mr. DEL VALLE confirmed this for Porto Rico also.

The 1929-30 Sugar Beet Crop in England and Wales.

The Preliminary Returns.

The Ministry of Agriculture and Fisheries has just issued preliminary returns for the 1929-30 beet sugar manufacturing campaign in England and Wales, which show greatly improved results. The ground lost in the previous year, when the acreage under sugar beet fell from 222,566 in 1927 to 175,734 was more than recovered, the area of 229,918 acres returned on the 4th June, 1929, representing the greatest so far placed under this crop. The good returns per acre in 1928 no doubt contributed much to this increase in acreage in 1929, which may also have been influenced in certain districts by the poor prices realised for the potato crop.

Weather conditions, generally speaking, were favourable. Severe frosts in February and March assisted the preparation of good seed beds and, although a generally hot and dry summer retarded growth, timely rains in October led to an increase in the weight of roots, which otherwise would probably have been very light. The weather continued mild and rainy throughout the autumn and early winter, with the result that the beets continued to increase in weight until the first weeks in January. This continued growth led to an average yield of about 8·7 tons per acre, compared with 7·7 in 1928 and 6·5 in 1927. Although this yield is still below the average yield obtained in most Continental countries, it is a distinct improvement and is actually the highest so far recorded in this country. The total quantity of roots delivered to the factories was 1,998,000 tons compared with 1,359,000 in 1928 and 1,449,000 for 1927. The rate of sugar content, which was very high in September, was reduced by the increased growth of the roots in late autumn and early winter, but is still high for this country, being about 17·6 per cent. as against 17·39 in 1928 and 16·12 in 1927, whilst the tare, influenced by favourable lifting conditions in the early part of the harvest, was lower than usual being 13·4 lbs. per cwt. as against 14·5 and 20 in 1928 and 1927 respectively. The total production of sugar was about 290,000 tons, and represents a yield of commercial sugar of about 2800 lbs. per acre, which is more than 1 cwt. higher than the previous record of 2674 lbs. in 1926.

The average price paid for beet under the terms of the beet contract was 52s. 9d. per ton, comparing with 52s. in 1928 and 55s. 6d. in 1927.

The amount of dried pulp produced was 138,145 tons, of which 74,431 tons were molassed and 63,714 tons plain. About 6 per cent. of the dried pulp has been exported. The amount of wet pulp produced was 18,837 tons.

Java Technical Notes.

CLASSIFICATION OF SUGARS. **Dr. P. Honig.** *Archief*, 1929, **37**, II, No. 44, 949-957.

White sugars are often classified according to their country of origin, or their manner of production, as Czecho crystals, Polish granulated, Java carbonatation or sulphitation whites, differentiation being made between direct white sugar and refinery granulated. In recent years a grade called "semi-refined" has appeared, made in cane or beet factories either from thick-juice (evaporator syrup) or from liquors obtained by remelting sugars, which latter may be the lower grades of the same factory or may be raws made by other factories. Such liquors are frequently purified in some way or other, for example, filtration with decolorizing carbon. In this article the classification of sugars is discussed in order to decide to what extent it may be possible with the methods used in Java, double carbonatation in particular, to manufacture sugars comparable with the standardized products of European and American markets. As means of differentiating between the various grades of sugars, the ash and the colour are the principal values available, and Lunden[1] has published the following figures :

	Ash content.	Colour (ϵ 509$m\mu$) (Java values).
Prima Refined	0·001 and lower ..	0·003
Refined, Melis II..........	0·02 ..	0·008
Porto Rico Refined	0·007 ..	0·020
European White .... (process unknown)	0·03 ..	0·018

The Porto Rico refined was from Central Mercedita where the "Suchar" process is operated, and a sample of such sugar examined at the Java Experiment Station gave 0·008 per cent. and 0·012 for the ash and colour values respectively. Different Czecho sugars were found by SANDERA and ZIMMERMANN[2] to have the following contents of soluble carbonate ash : fine crystal, 0·013 ; normal crystal, 0·023 ; crystal, 0·007 ; cubes, 0·009 ; and pilé, 0·013 per cent. At the Java Experiment Station the following results were obtained with samples of European white sugars :—

	Polarization at 28°C.	Water	Reducing Sugars	Ash (incineration)	Conductivity 40-Brix × 10^{-6}	*pH*	Colour (ϵ 509 $m\mu$)
Dutch Refined Melis I ; WSR	99·50 ..	0·06 ..	0·016 ..	0·007 ..	8 ..	5·2 ..	0·005
Beet White, DLO 1928-29 campaign	99·50 ..	0·08 ..	0·013 ..	0·021 ..	16 ..	6·2 ..	0·011
Ditto, mark SVG, same campaign..	99·50 ..	0·07 ..	0·013 ..	0·016 ..	19 ..	6·3 ..	0·014
Ditto, mark FGR, same campaign ..	99·60 ..	0·08 ..	0·017 ..	0·016 ..	18 ..	6·4 ..	0·011

These analyses show a very low ash content for the beet white sugar, about 0·02 per cent. ; and if one were to accept the ash percentage as the criterion of purity these sugars would be classified as very pure. An examination at the Experiment Station of a number of Java white sugars shows that several white sugar factories in Java make sugars with an ash content lower than 0·02 per cent., the average analyses of such sugars (denoted as SHS-B) being as follows : pol. at 28°C., 99·5 ; water, 0·07 ; r.s., 0·037 ; ash, 0·016 ; conductivity $\times\ 10_{-6}$, 22 ; *pH*, 5·6 ; colour (ϵ509 mμ), 0·018 ; and colour after washing, 0·011.

1 *Fortsatta studier over sockerfabrikationens Fysik och Kemi*, 1928, 17.
2 *Zeitsch. Zuckerind. Czecho.*, 1927-28, 405-412.

Comparing these figures with those for the Dutch sugars tabulated above, it appears that the purity is almost the same, excepting that the r.s. and colour are somewhat higher. Especially is the quantity of colour round the crystal a little greater than in the Dutch white sugars, from which it follows that Java sugars must be better washed in order to be equivalent to European white sugars. If the technique of washing sugars were improved by using a better quality of covering liquor, by boiling a uniform grain, and by carefully washing in the centrifugals with water and steam, a sugar could be manufactured corresponding in composition and appearance to the best European semi-refineds.

In Fig. 1 are given the complete extinction curves of some of these sugars, besides a molasses sugar (MS) from a carbonatation factory washed until all the syrup surrounding the crystals was removed, as well as some American refinery products, boiled from 1st, 2nd, and 3rd liquors having purities from 99 to 96°.[3] It is seen that a 3rd product boiled from a cuite of 96° purity has a colour higher than a good Java white. But one must not imagine that refined sugars are all boiled from 1st liquors of very high purity, only a part of the product of the refinery being thus obtained, namely loaves, cubes, extra large grained sugars (Bristol crystals), etc. The more ordinary sugars, as melis and castor, are got from the lower run-offs, which are filtered and decolorized, and often have a purity below 96°. Sugars obtained from such liquors are only in a very restricted sense superior to the good grades of plantation or beet white sugars. Java white sugar factories can make liquors from their carefully affined C and D sugars, which after a thorough filtration certainly are equal to the liquors of many refineries, which use such liquors as primary material for their "refined" sugars. Besides ash and colour, grain uniformity contributes to the general appearance of a sugar. On this condition depends to some extent the reflecting power of the sugar, and below are given typical reflection curves for different sugars, using light of different wave-lengths. In most sugars one finds a more or less pronounced yellow tint, though sometimes the tint is reddish, while again when too much blue wash has been used it may be tinged with that colour. In order to obtain an expression of the yellow tint, it suffices to take the difference in the reflection between the two wave-lengths, 560 and 440 $m\mu$, and thus one arrives at the following figures :—

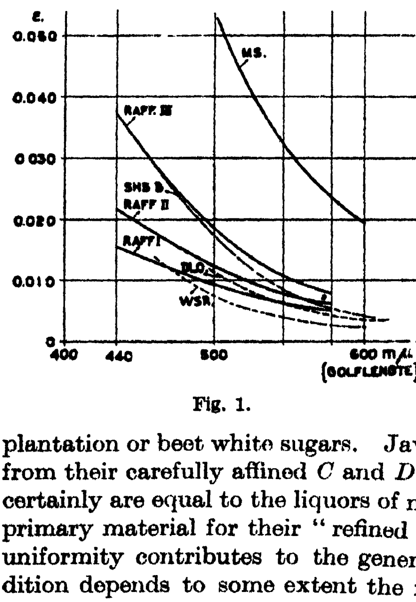


Fig. 1.

Grade of Sugar.	Brilliance. Reflection at 560 $m\mu$		Reflection at 440 $m\mu$		Yellow Tint, Reflection at 560 *minus* that at 440 $m\mu$
WSR (Melis, refined)	78·5	..	68·0	..	10·5
DLO (beet white)	75·0	..	66·5	..	8·5
SVG (beet white)	73·1	..	—	..	—
SHS (Java superior)	71·0	..	61·0	..	10·0
SHS (Ditto, having a pronounced yellow shade) ..	68·2	..	52·0	..	16·2

[3] See *Journal of Research*, 1929, 341.

A value of reflection at 560-440 $m\mu$ < 15 corresponds to a yellow tint such as sugar boiled under too low a vacuum may possess, when caramelization may have occurred. This yellow tint is very low for the SSS given in Fig. 3, namely 4. According to this value, the SSS sugar is whiter than the beet white sugars mentioned above. But light reflection is strongly affected by the size of crystals, and so it comes about that Java SSS which contains much colouring substances (ϵ509 $m\mu$ = 0·084) reflects considerably more than a

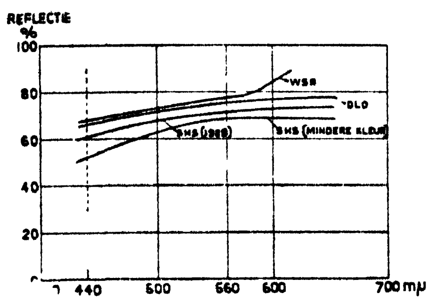


Fig. 2.

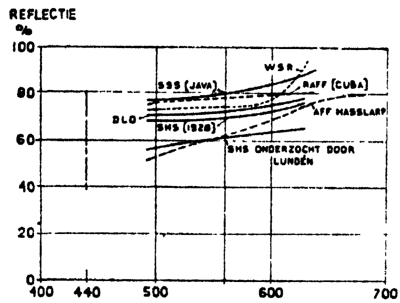


Fig. 3.

refined. Sugar SHS-B, the analysis of which was given above, has a reflection at 560 $m\mu$ of 73·5, and a yellow tint of 9·0, which value is practically equal to the colour of European beet whites. An important fact follows from these determinations, concludes the author, namely that it is possible in ordinary operation in Java to manufacture a sugar possessing internal and external characteristics practically equivalent to those of European white sugars.

ORGANIZATION OF THE JAVA SUGAR EXPERIMENT STATION. **J. T. L. van Horn.** *S.A. Sugar J.*, 1930, **14**, No. 1, 39-41.

Many of those who write about science in the Java sugar industry make the tacit assumption that most of the brains and expert knowledge that are brought to bear on the problems of planters and manufacturers in that country are concentrated at Pasoeroean; and that most, if not all, of the research is done by the eminent experts on the Station's staff. However, it is no discredit to this magnificent station to say that this is very far from being the case. Aside from such highly specialized subjects as genetics, entomology, and phytopathology the real function of the Station, and admittedly its chief value, is to act as a co-ordinating agency and a clearing house for the scientific and practical work that is done at the 185 plantations and mills. Each of these has a large staff of scientifically trained men of its own, some of whom have passed through the Pasoeroean station to better paid positions in the industry. It is these men who furnish most of the experimental and technical data which are collected, edited, and published in the *Archief*. The scientific and technical basis of the Java sugar industry now rests on the knowledge afforded by a total of about 22,000 complete field experiments, few or none of which were actually laid out or harvested by the Station staff. In most cases they were made and completed entirely on the initiative of the experts at the factories, often, it is true, in consultation with the E.S. The function of Pasoeroean is largely limited to collecting the results of these experiments (now numbering more than 2000 a year) and deciding which were made with sufficient care and completeness to deserve incorporation into a permanent body of knowledge.

This angle of the Experiment Station question is emphasized for the reason that in many sugar producing countries where experiment stations

have been recently established or are contemplated, the members of the sugar industry have the impression that their new institution will automatically become a fountain of valuable knowledge without further trouble or expense on their part. That is not the fundamental idea behind the Java E.S., at least. This Station is first and foremost a common reservoir into which the experiments made and the experience gained at the plantations and the factories are poured, mixed, and taken out for the benefit of all. Without this vast inflow of experience from its outlying constituents its usefulness would be decidedly smaller than it now is. In thus pointing out the real, dominant function of a modern E.S., it is not at all the writer's intention to belittle the work which Pasoeroean initiates and carries out on its own responsibility. This special work relates to highly technical collateral subjects, such as the life histories of insect pests, the etiology of plant diseases, the physiology and cytology of the sugar cane—these being matters which are too far removed from practice to be done by the factory men. But the results of such recondite and often highly important studies have later to be translated into practice, and this cannot be done without the aid of men on the estates who are able and willing to undertake expensive and troublesome experiments in collaboration with the station officials.

Besides its work on agricultural problems Pasoeroean has an expensive programme of research on engineering and technological problems. But, single-handed, the E.S. would be unable to make any noteworthy impression on these outstanding problems. It must, and does, depend on the factories to provide the necessary factory-scale experimental equipment under their own roofs, and to furnish the labour and materials necessary for their operation under test. It may be concluded, therefore, that a modern E.S. is much more than a nice building housing a number of well qualified experts in various lines of science. If behind these experts there is not a large body of practical men to contribute of their own experience, and ready and willing to go to the extra trouble and expense of proving the usefulness or otherwise of new ideas, the Station will be like a body without a head, or a general without any army.

THE TEMPERATURE CO-EFFICIENT IN THE POLARIZATION OF RAW SUGAR. **K. Douwes Dekker.** *Archief*, 1929, **37**, No. 42, 909-914.

In a contribution published last year, the author discussed the influence of the temperature and of the manner of dissolving in the polarization of pure sugar as practised in Java at the present time.[1] Assuming that the 100° point of the saccharimeter is correct, and polarizing at a temperature of 30°C., it followed from these conclusions that if 26·048 grms. of pure sugar are dissolved at 30°C. in a 100 c.c. flask calibrated at 17·5°C., then one may expect this solution to polarize 99·63, in other words, 0·37°V. lower than the result which would be obtained if the International procedure were followed. This amount may be divided into :—0·081 for the difference of concentration in the case of 26 grms.; 0·153 for the influence of temperature on the rotation of sucrose ; and 0·140 for the influence of temperature on the tube and saccharimeter. In the present paper he considers the question of the effect of temperature on a raw sugar containing 1 per cent. of reducing sugars, prepared and polarized by the so-called Java method of working at 30°C. On calculating the diminution of polarization under these conditions, one arrives at 0·37 for the effects on the sucrose and 0·03 for those on the reducing sugars, that is, assuming no other substances than sucrose or reducing sugars play a part.

[1] *I.S.J.*, 1929, 321.

But what actually is the difference as determined experimentally? In order to answer this, 16 raw sugars were examined at the Experiment Station according to the two methods. Using the Java method outlined above, and polarizing at 28°C., figures varying from 96·25 to 95·05 were obtained, and in the International procedure at 20°C., (using the recently installed constant temperature chamber there) the polarizations varied from 96·22 to 99·37. But the differences were very irregular. This was attributed to the reducing sugars (0·162 to 0·937 per cent.). containing unknown proportions of dextrose and levulose, which exerted effects that could not be exactly established. Altogether the difference between the two sets of polarizations lay between 0·05 and 0·50, but it was not possible to state average figures for the reasons given above.

EXAMINATION OF DIFFERENT HEAT-INSULATING MATERIALS. **E. C. von Pritzelwitz van der Horst and L. D. Teutelink.** *Archief*, III, 1929, Meded. No. 21, 1115-1146.

A comparative examination was instituted by the authors into the heat-insulating properties of different materials, In carrying out this work, they used the method recommended by BENISCH and ANDERSEN,[1] in which use was made of an iron tube, heated internally by an electrical resistance, and covered externally with the material under examination. In general the heat-conductivity coefficient of so-called "85 per cent. magnesia" (composed of a mixture of basic magnesium carbonate and asbestos) was found to be somewhat higher, and consequently less favourable, than is indicated by the data available in the literature. Thus, whereas RANDOLPH gives a conductivity figure of 0·0583 for this magnesia, values were found in these determinations for 85 per cent. magnesia, thinned with water in the proportion of 1 : 3, and put on in successive layers, from 0·073 to 0·0129. Much lower heat conductivity figures were obtained when the 85 per cent. magnesia was applied "lightly," that is, so as to give a covering of very low density, in which case values as low as 0·040 to 0·045 were obtained. These coverings however, were mechanically weak, and liable soon to disintegrate. A mixture of calcium carbonate and asbestos gave (as one would expect) a poor result, viz., 0·364 to 0·437. Blue asbestos in the form of loose fibres, thinned in the proportion of 1 : 3 with a mixture of water and water-glass (1 : 15), and applied in successive layers, give figures from 0·155 to 0·218. Kieselguhr mixed with water in the proportion of 1 : 1 covered with cloth and painted with zinc white, gave carrying results from 0·199 to 0·429; but kieselguhr mixed with 10 per cent. of blue asbestos, laid on lightly, gave the good figure of 0·049 to 0·052. It was noticed that some of these heat-insulating preparations attacked the walls of the iron pipes which they covered.

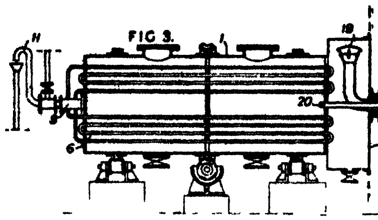
MOLASSES UTILIZATION. **P. C. Nicola.** *Archief*, 1929, **37**, No. 35, 790-797.

Molasses should have as great a future as coal tar; and, though the problem of its utilization has been considered, all the possibilities of its use have not been completely studied. Alcohol, yeast, and fusel oil, carbon dioxide, glycerin, organic fatty acids, are products which may result from its biological treatment. By chemical treatment, one may obtain betaine, glutamic acid, colouring substances; ammonium salts, potash salts, carbon and tar are produced by carbonization at low temperature; and similar products also at high temperatures, though also one can isolate amines, cyanides, acetone and pyridine.

1 *Mitteilungen uber Forschungsarbeiten*, heft 63.

Beet Factory Technical Notes.

Lafeuille Crystallizer Pan.—This combined boiling and crystallizing apparatus has been introduced with success into the cane sugar industry in the Philippines,[1] where a number of them will be in operation in that country next crop. Now it makes its début in the beet industry, the capacity used being 400 h.l. (8800 gallons or 1400 cub. ft.), and an account of its operation is given by the inventor himself.[2] Syrup centrifuged from 1st massecuite was introduced into the apparatus and grained without the introduction of any *pied-de-cuite*. being concentrated to an apparent Brix of 99°. This mass was cooled with successive charges of water to progressively lower the Brix to about 95°. The total time it was in the Lafeuille was about 10 hours, half for boiling, graining and concentration, and half for cooling to about 50°C. and for diluting. This cooled mass was then run into an ordinary mixer where the cooling was continued to 46°C., ready for delivery to the centrifugals, in which curing was easy, giving a very light and very dry sugar. An average massecuite purity of 74·9° was obtained, that of the run-off being 57·4°. It results clearly from these facts, says the author, that a Lafeuille crystallizer-pan of 400 h.l. total capacity with one or two mixers placed below amply suffices for working up the second syrup in a *sucrerie* of 2000 to 2400 tons of roots without the necessity of any vertical boiling pan or any ordinary crystallizer. It is important to point out that in the factory concerned the Lafeuille boiler was heated entirely with vapours at 110°C. taken from the second body of the evaporators.



LAFEUILLE'S CRYSTALLIZER PAN.
(U.K. Patent, 252,686; *I.S.J.*, 1926, 501.)

Sugar in Press-Cake.—It is now more than a year since the appearance of a patent applied for by Dr. CLAASSEN made quite a sensation in the German sugar world.[3] This well-known sugar expert claimed to be able to reclaim a remarkable amount of the sugar hitherto lost with the filter-press cake by simply mixing the mud with hot water, digesting this suspension for about an hour, and filtering for a second time.[4] If the analysis of the original press-cake showed it to contain, say 20 lbs. per ton, the total amount of the sugar recovered by digesting the mud *plus* the amount of sugar still contained in the mud was far more than 20 lbs. mentioned—in fact, nearly twice as much. This sounds extraordinary. No wonder it aroused great interest over there, the more so as Dr. CLAASSEN's reputation left no doubt as to the seriousness and sincerity with which the basic experiments had been carried out. He had introduced the patented process in his factory, where it worked as successfully as anybody could bring himself to believe. He was quite able even to boil strikes from nothing but the syrup resulting after the evaporation of the thin liquor obtained by extracting the mud. During the last season the process has been thoroughly tested in many German factories, or rather small-scale experiments were carried out with it. But hardly any factory could succeed in getting more sugar. On the other hand, there is no doubt that in CLAASSEN's factory there is more sugar in the press-cake than the usual analysis shows, and that he recovers this extra sugar by his process. In all cases, of course, the press-cake had been washed out with water right in the presses, as normally. The explanation, points out Dr. ERICH TROJE,[5] seems to be that at CLAASSEN's

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1 See *I.S.J.*, 1928, 397; 1929, 388.
2 *Bull. Assoc. Chim. Sucr.*, 1929, 46, No. 12 540-541.
3 *I.S.J.*, 1929, 225, 573. 4 *I.S.J.*, 1929, 440. 5 *Sugar News*, 1930, 14, No. 2, 15.

factory a special diffusion process is being employed using two or three diffusion cells only, but treating the cossettes with live steam before they enter the cells. Apparently this process causes more pectin substances, etc., to go into solution than usually enter the raw juice, and these colloidal substances later on form part of the press-cake and absorb sugar which they hold so firmly that it cannot be extracted by a short washing process or by the usual method of analysis. Only hot digestion during a considerable time and at a certain dilution is able to make the sugar diffuse gradually into the surrounding liquor. These studies make it very likely that it is only the great percentage of colloidal matters present in a press-cake produced by that special Steffen diffusion process which is responsible for the peculiar sugar-retaining qualities of the filter-press cake Dr. CLAASSEN is working with.

Refining Values.—Refining operations, points out Dr. WENZEL KONN.[1] can be controlled by the observation of certain physical and chemical values, viz., the surface tension, using DU NOÜY's method ; the luminescence, using the "Luminometer" or ultra-violet light measuring apparatus, recommended by Dr. SANDERA ; the *pH*, using the colorimetric and the potentiometric methods ; the colour, using SANDERA's objective photometer ; and the conductivity, using the "Conductometer" apparatus. Following are the main observations made : On covering with raw beet sugar with cold water up to 30 per cent. of the raw sugar the luminescence and colour diminished with the conductivity, the solution of the washed crystals showing 1·71° Stammer and 0·05 per cent. of carbonate ash. By washing the raw sugar with 60 per cent. covering liquor, white crystals were obtained with only 7 per cent. of the original colour and 4·9 per cent. of the original carbonate ash, but its luminescence was fairly high, viz., 19°, having been over 33° originally. Again, using 40 per cent. of liquor made with pure sugar for washing up the raw sugar, a white sugar was obtained, which in regard to its physical and chemical properties corresponded to domestic white sugar. Following this, decolorization was studied. Using 2 per cent. of bonechar, about 56 per cent. of the colouring substances were removed, the luminescence was diminished from 26 to 12 per cent., and the carbonate ash to 23 per cent. of its original amount. On decolorizing with kieselguhr, "Norit," and "Carboraffin," the carbonate ash in each case remained unaltered ; but with the reduction of colour the luminescence also fell, from which it follows that the substances causing the luminescence are not combined with the ash constituents. Surface tension appears to be in a general way connected to the contents in organic and inorganic impurities, though it is not possible to bring it into any direct relationship with either of these two constituents, for example, the ash.

Conductivity and Sugar Quality.—Writing on the factors that may affect the quality of beet white sugars, R. J. BROWN, of the Research Laboratory of the Great Western Sugar Co., of Denver, Cal.,[2] points out that under certain conditions in the granulator a sugar is produced which lacks lustre, due to the formation of a layer of microscopic crystals on the surface of the main crystal. This layer of minute crystals is capable of hiding, to some extent, any syrup film which may be on the present crystal. Colour alone is not a proper measure of the quality of sugar, and consequently the electrical conductivity test is applied in order to obtain an indication of the amount of "ash" in the film of syrup. This ash may amount only to a few hundredths of a per cent., and alone would not be objectionable. The objections arise from the fact that the ash is accompanied by a

1 *Zeitsch. Zuckerind. Czechoslov.*, 1930, **54**, No. 17-18, 173-186.
2 *Sugar Press*, 1930, **14**, No. 1, 24-5.

small amount of colouring matter and hygroscopic impurities. In poorly washed sugars most of this ash is contained in the syrup film on the crystals and this can be removed by proper washing. Had perfect centrifugal work been done on these sugars originally, all of them would have been of high purity and "A" colour or better. For the last few years conductivity has been a standard test on all sugars and it has aided greatly in insuring the production of highest purity. For a long time the production of white sugar which would give a uniform candy grade was an unsolved problem, some making much darker candies than others under the same conditions. The cause was eventually located in the minute trace of colloid matter which the sugar carried. Hence, the answer to the problem of producing a satisfactory candy grade lies in producing a sugar free from this trace of objectionable colloidal matter or rendering the colloidal matter inactive.

Miscellaneous.

Saving Heat.—Engineer J. Hamous, connected with one of the Czecho factories,[1] points out that the temperature of the juice in the carbonatation tanks falls during the process about 6°C. this being caused by the entering CO_2, which carries off an amount of hot vapour. It was calculated by him that the heat thus lost is equivalent to about 1·2 kilo. of vapour from the second vessel of the evaporator for every 100 kilos. of roots worked, that is 2·5 kilos. for the two sets of carbonatators. This represents an amount of vapour which would suffice for heating 100 kg. of diffusion juice from 50 to 63°C., or a part of the water used for diffusion or for some other useful purpose. This heat might be utilized, he says, by inserting in the flue of the carbonatation tank a trap containing coils through which diffusion juice or water is circulated, and thereby heated. *De Vecchis process.*—In the Derjugino factory, Russia, 17,839 dz. (1784 tons) of beets were dried to give 438·3 tons of dehydrated slices, the loss of sugar in the drying process being 0·134 per cent. of the weight of the beets. Analysis of the dried slices gave : sugar, 65·86 ; water, 3·41 ; and reducing sugars, 0·176 per cent. Coal consumption was 10·31 per cent. of the roots. Three other beet drying plants are planned to operate next season, making four in all to dry 15,000 tons in the season, this to be worked up to sugar at Derjugino, where the juice will be clarified partly by the ordinary method, and partly by phosphate according to the De Vecchis process.

Erratum.—On page 153 of March issue, under "Sena Sugar Estates" for "277,000 tons of cane" read "750,000 tons of cane."

Sugar Federation Deputation to Mr. Snowden.—A deputation of the Sugar Federation of the British Empire, introduced by the Rt. Hon. L. S. Amery, M.P., the Chairman of the Federation, waited upon the Rt. Hon. Philip Snowden, M.P., Chancellor of the Exchequer, on Tuesday, 25th March. The following constituted the deputation, which covered every element of the Empire industry from growing to refining :—The Rt. Hon. L. S. Amery, M.P. (Chairman) ; Sir Edward Davson, Bart. (British Guiana) ; Mr. E. A. de Pass (West Indian Colonies) ; Mr. W. Scott Herriot (British Empire Sugar Machinery Manufacturers' Association) ; Mr. W. A. Hobbins, D.S.O. (Queensland Sugar Board and Fiji Sugar Industry) ; Major Sir Humphrey Leggett, D.S.O. (South African Sugar Association) ; Sir Leonard Lyle (British Sugar Refiners' Association) ; Mr. V. A. Malcolmson (British Sugar Beet Society) ; Mr. Charles McNeil (Queensland Sugar Board) ; Mr. L. H. Pike (representing the Agent-General for Queensland) ; The Hon. Sir Louis Souchon, C.B.E. (Mauritius Chamber of Agriculture) ; and Mr. Harold T. Pooley (Secretary).

[1] *Deut. Zuckerind.*, 1930, 55, No 5, 119 ; *Sowjet-Zucker* 1929, No. 13.

Pan Boiling.[1]

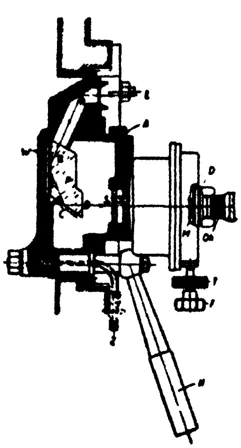
Its Scientific Control and the Zeiss Industrial Refractometer.

By S. J. SAINT, B.Sc., A.I.C.,
Department of Science and Agriculture, Barbados.

During the crop season of 1928 an investigation was made at Sandy Lane factory of the applicability of the Zeiss industrial refractometer to the scientific control of boiling.[2] This investigation has been continued, and extended at Carrington factory, Barbados.

The three strike system of boiling sugar (GEERLIGS' "absolute recovery" process) is adopted at Carrington. The apparent purity of the three massecuites is kept approximately at 80°, 70° and 55°. Calculations based on the analytical determinations and recorded data showed that the boiling of the *A* and *B* strikes was carried out in a similar manner to the boiling of corresponding strikes at Sandy Lane. Similar coefficients of supersaturations of the mother-liquor were maintained. The results of the two seasons' work show that the practical pan-boiler maintains an "apparent" coefficient of supersaturation of 1·15 for *A* strikes and 1·2 for *B* strikes. The calculation of tables for the boiling of *A* and *B* strikes with the aid of the refractometer can therefore be based on these supersaturations.

In the case of the *C* or final low purity strike, the pan-boiler at Carrington adopted a somewhat different method to that used by the pan-boiler at Sandy Lane. After the introduction of molasses the "apparent" coefficient of supersaturation was raised to 1·2 as at Sandy Lane and the boiling was identical up to about 60 per cent. of the striking volume of the pan. But the pan-boiler at Carrington then proceeded gradually to raise the concentration of the massecuite until at a height of about 80 per cent. of the striking volume the "apparent" coefficient of supersaturation of the mother-liquor had been raised to 1·35 and at a height of 100 per cent. the supersaturation reached 1·45. This figure is equivalent to a true supersaturation of the mother-liquor of 1·25 and corresponds to a concentration of about 96° Brix for the massecuite. This was the desired concentration for striking the massecuite so that after the pan had been filled very little time was spent in further concentration. At Sandy Lane, the pan-boiler operated the pan for the *C* strike so that the apparent coefficient of supersaturation of the mother-liquor remained at 1·2 until the pan was full. The further entry of molasses was then stopped and the massecuite was concentrated until the mother-liquor had an "apparent" coefficient of supersaturation of 1·35 which corresponded to a concentration of about 93° Brix. for the massecuite.



There is no doubt that the method of dealing with the low purity strike adopted at Carrington factory is superior to the method adopted at Sandy Lane factory. Increasing the coefficient of supersaturation of the mother-liquor resulted in a considerable decrease in the purity with a corresponding increase in the amount of crystal sucrose in the massecuite. There was no sign of false grain as the result of increasing the supersaturation. It has already been pointed out that an "apparent" coefficient of supersaturation of 1·45 in the mother-liquor under consideration corresponds to a true coefficient

1 Condensed from an article in *Tropical Agriculture*, 1930, 7, No. 1, 3-8.
2 *I.S.J.*, 1929, 163.

of supersaturation of 1·25. As will be shown later, spontaneous crystallization of a high purity cane syrup takes place in the absence of sucrose crystals at an "apparent" supersaturation of 1·33 to 1·35; at the purity of the syrup this will be almost equivalent to the true supersaturation. It is therefore highly probable that in the low purity mother-liquor of a *C* strike and in the presence of sucrose crystals, spontaneous crystallization will take place at a higher supersaturation than 1·35. It would appear then that the method of boiling low purity strikes adopted at Carrington factory is capable of further extension. The true coefficient of supersaturation of the mother-liquor of the low purity strike could be safely raised to 1·35 before striking into the crystallizer. This will result in a considerably greater extraction of sucrose from the final molasses. The ordinary pan-boiler who has to judge the concentration of the massecuite by eye is very chary of raising the concentration, because if he makes a mistake false grain may form, and he is therefore inclined to keep the massecuite too thin. With the aid of the refractometer, however, it is possible to determine the concentration of the mother-liquor accurately at any stage of the boiling process, so that the supersaturation of the mother-liquor can be raised with safety.

GRAINING OF CANE SYRUPS.

The process of forming sucrose crystals from syrups—the graining process—is as important a part of the art of pan boiling as the subsequent growing of those crystals. If, therefore, the industrial refractometer is to be successfully applied to pan boiling it is equally necessary to show that it can be used to control crystal formation.

Uniformity of the Grain Size.—The method of graining adopted by pan-boilers in Barbados is usually described as the "waiting" method. The syrup is concentrated in the pan until the supersaturation of the syrup becomes so great that crystals form spontaneously. The concentration of the syrup is continued until a sufficient number of crystals are judged by eye to be present. The supersaturation of the syrup is then reduced by a charge of dilute syrup so that fresh crystals cease to form. It is evident that a perfectly regular grain cannot be obtained by this method since the formation of crystals must occupy a definite time period. It also follows that the longer this time interval is, the greater will be the differences in size between the first formed and the last formed crystals. A good example of the effect of time of graining on uniformity of crystal size in the "waiting" method of graining was afforded by the methods adopted at Sandy Lane and Carrington factories. At Carrington factory graining for a *C* strike was carried out with direct steam and between eight and ten minutes elapsed from the time the first crystals formed until graining ceased. The result was a fairly regular crystal size and the massecuite built on this grain gave little trouble at the centrifugal. At Sandy Lane factory, back pressure steam was used to grain the syrup and the formation of sufficient crystals for a *C* strike occupied at least 20 minutes. The crystals so formed were very irregular in size and the massecuite built on this grain was often difficult to cure.

In order to obtain a perfectly regular grain it is necessary to induce the syrup to deposit the requisite number of crystals at one and the same time. So as to attain this end a high supersaturation must be formed suddenly in the syrup. The graining process which most nearly fulfils this condition is the method by which the crystallization is induced in the syrup by suddenly raising the vacuum. The temperature at which the syrup boils is lowered by this reduction in pressure and as the solubility of sucrose decreases with the

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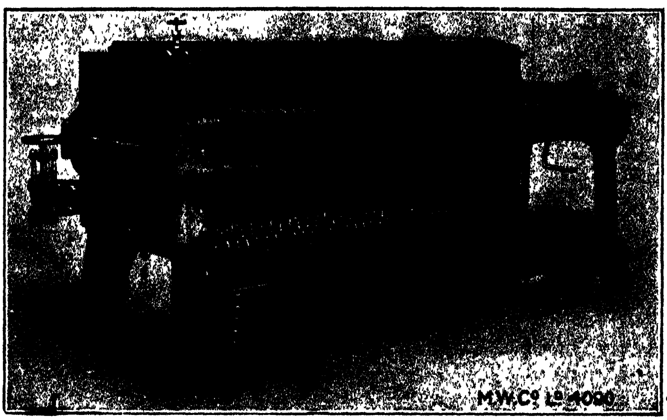

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decrease in temperature, the supersaturation necessarily rises. If the purity of the syrup has been previously determined, then the supersaturation of the syrup can be calculated and followed if the concentration of the syrup and the vacuum prevailing in the pan are known. The concentration of the syrup can be determined with the refractometer, the purity of the syrup is readily found, and the vacuum will be indicated by a suitable gauge; the supersaturations existing in a syrup at graining point can therefore be determined.

It was found that when the "waiting" graining process was followed for the same types of strike the data obtained were very similar. It was found that with a syrup of an optical purity of 85° to 86°, crystals can first be distinguished under the microscope when the apparent coefficient of supersaturation is between 1·33 to 1·35. It can be taken as established that under practical conditions spontaneous crystallization commences in a syrup of 85° to 86° optical purity at a supersaturation of about 1·35. In graining a *C* strike the "apparent" coefficient of supersaturation of the syrup was raised to a maximum of about 1·6. When graining for an *A* strike in which a smaller number of crystals is needed, the "apparent" coefficient of supersaturation was raised to a maximum of about 1·5.

If it is assumed that a sufficient number of crystals can be formed for a *C* strike by suddenly raising the supersaturation to 1·6, then a curve can be drawn showing for a given purity syrup the relationship between concentration and vacuum at this supersaturation. In a similar way it is possible to draw a curve for the supersaturation of 1·3; this is approximately the maximum supersaturation which can be obtained without spontaneous crystallization. With the aid of these curves it is possible to boil the syrup at a high vacuum until the concentration of the syrup indicates that an "apparent" coefficient of supersaturation of 1·3 has been reached. The vacuum can then be lowered so that at that vacuum and concentration the syrup will have a supersaturation of 1·3 when the concentration of the syrup is sufficiently high to give a supersaturation of 1·6 at the high vacuum. These data can be read off easily from the graph.

For instance, assuming that the syrup is boiling at a vacuum of 63·5 cms. then the concentration of the syrup is raised until the refractometer indicates 82 per cent. of dry matter which corresponds to a supersaturation of 1·3. The vacuum is then lowered to 49 cms. and boiling is continued until the refractometer indicates a dry matter of 85·5 per cent. At this concentration and a vacuum of 49 cms. the "apparent" coefficient of supersaturation is 1·3, but at this concentration and a vacuum of 63·5 cms., the "apparent" coefficient of supersaturation of the syrup is 1·6. As soon therefore as the concentration reaches 85·5 per cent. the vacuum is raised to its original amount. In this way the supersaturation is suddenly raised from 1·3 to 1·6, the syrup boils violently and grain forms throughout the mass of syrup. Further grain formation can be prevented by charging the pan with syrup and reducing the coefficient of supersaturation to about 1·15. This method of graining was tried out in practice and yielded a very uniform grain. It is considered that this method is well adapted for use with the refractometer since, in this way, a strict control can be maintained of the supersaturation of the syrup.

Number of Crystals.—There is no known rapid method of determining the number of crystals in a graining syrup. BALDWIN[1] has patented a device which consists of a microscope fitted into the wall of the pan and means are

[1] *I.S.J.*, 1918, 243.

provided for trapping a known volume of syrup so that an actual count of the number of crystals can be made It would seem, however, that by the time the grain had been counted, the result would be vitiated by the fact that an unknown number of new crystals had formed during this period. Practically, there is only time to make a visual estimate of when a sufficient number of crystals have formed during graining. This estimate can be made more exact, by standard tablets which give the density population for known numbers of crystals.

In the "waiting" method of graining, the practical pan-boiler estimates when a sufficient number of crystals have formed by examining a sample of the graining syrup against the light on a plate of glass with or without the aid of a hand lens. The estimate of the pan-boiler depends solely on his previous experience and, as will be shown, his estimate is a very approximate one and is probably no more exact than the estimate an intelligent person would obtain with the aid of standard tablets and no previous experience. A third method of obtaining the requisite numbers of crystals for any particular strike is suggested by the work which has been carried out on graining with the aid of the refractometer. The refractometer enables a continuous control to be exercised over the supersaturations of the syrup in the pan and it would seem that if a certain supersaturation were suddenly introduced into a syrup, the number of crystals formed would be proportional to the degree of supersaturation.

KUCHARENKO has shown that the velocity of crystallization increases rapidly with the supersaturation of a sucrose solution. In these investigations it has also been found that the number of crystals forming at a supersaturation of 1·5 is much less than the number forming at a supersaturation of 1·6. It is highly probable that the purity of the syrup and other factors will influence the effect of supersaturation on crystal numbers, but if these factors could be worked out and allowed for a method of defining the required number of crystals in terms of the supersaturation of the syrup would seem to have possibilities even in the hands of a novice. It was only possible to carry out one experiment on this method, but, if possible, this matter will be further investigated during next crop season. In the experiment undertaken the supersaturation of the syrup was suddenly raised from 1·3 to 1·6 and the number of crystals which resulted were counted. It was found that 249,000 crystals were present in 1 c.c. when calculated on the same basis as previously described. This number compared very favourably with a count made under the microscope of crystals formed in the waiting process when a similar supersaturation was obtained.

OXFORD PROCESS.—In Parliament it was stated by Dr. Addison in reply to a question by Viscount Wolmer that the Sugar Beet and Crop Driers, Ltd., had approached the late Government and the present one for State assistance in the shape of a loan or bank guarantee, or both, and that this request had on both occasions been refused.

HOWARD HARVESTER.—A promising demonstration of this machine was made in November last at Bundaberg, Queensland, and it is reported[1] that, although the machine is only in the experimental stage, the inventor, Mr. A. C. Howard, well known as the designer of the Austral Auto-cultivator, is well on the ay to commercial success. He demonstrated the ability of the harvester to cut nd top cane successfully over short runs. It is a compact machine, weighing about 2 tons, convenient to handle, and has somewhat the appearance of a motor utility truck.

[1] *Aust. Sugar. J.*, 1929, 21, No. 9, 542.

Publications Received.

Die Zuckerfabrikation mit besonderer Berücksichtigung des Betriebes. Dr. H. Claassen. Sixth Edition. (Schallehn & Wollbrück, Magdeburg, Germany). 1930. Price : 22 RM.

In the first preface of this book, which was published in 1901, the author stated its purpose to be "to bring to the mind of the sugar technologist all that should be observed in the working of the beet factory." He added that it might also serve as a guide for the novice in practical beet sugar manufacture. In the several editions of the book that have been published since, much more than the aims modestly expressed in these words has been realized. CLAASSEN's book is now accepted as one of unusual value to practicians and students alike. It presents in clear and concise words the author's carefully considered views on every phase of the art of beet sugar manufacture. One now finds in it the accumulated experience of an investigator whose habit it has been to put much to the test in the factory or in the laboratory. This sixth edition by a few additions here and there (dealing with beet dehydration, pre-defecation, use of active carbon, pressure evaporation plant, etc.) brings quite up-to-date a work that can be read with advantage and pleasure by beet and cane technologist alike.

Heat Transfer and Crystallization. Prof. W. L. Badger. Article VIII. Applications of the Forced Circulation Evaporator. (Swenson Evaporator Co., of Harvey, Ill., U.S.A.). 1930.

Some results obtained with the forced circulation evaporator, promised in the last article,[1] are here given. One of its most important practical advantages is its ability to work with extremely viscous liquids. Thus, the residue from a fermentation and distillation operation was tested comparatively with natural circulation and forced circulation evaporators, when it was found that the latter was operating at about 10 times the rating for a similar temperature drop, but with a lower boiling point and consequently a higher viscosity. Another application is to liquors that are subject to foaming and entrainment, in dealing with which this new type of evaporator is said to have been particularly successful. Further, scale formation in it is always less than ordinarily.

Steam : Its Generation and Use. Eleventh British Edition. (Babcock & Wilcox, Ltd., London, E.C.4.).

B. & W.'s "Steam," which comprises one of the most useful hand-books on the subject yet published, has been brought up-to-date. In view of the demand for steam generators carrying higher pressures than were formerly used, special interest will be aroused in the descriptions of modern power stations, as those of Langerbrugge and North Tees. Steam and other tables have been collected and converted from various sources, and a collection of boiler tests indicates the high thermal efficiencies obtained at the present time. The data on bagasse and bagasse furnaces remain the same as in the last edition.

Variety Tests of Sugar Canes in Louisiana during the Crop Year, 1927-28. George Arceneaux and F. D. Stevens. Circular No. 88 ; U.S. Department of Agriculture, Washington. (Superintendent of Documents, Washington, U.S.A.). 1930. Price : 5 cents.

Contents.—Introduction, seasonal conditions, experimental methods (plot arrangement, sampling, sugar calculations and statistical methods), plant-cane varietal tests, discussion of results, mill test, stubble-cane test, seedling testing, date-of-planting tests, summary and conclusions.

Proceedings of the Third Congress of the International Society of Sugar Cane Technologists held at Soerabaia, Java, June, 1929. (Published by the Executive Committee). 1930. Price : 12·5 guilders.

1 *I.S.J.*, 1930, 152. The forced circulation evaporator as developed by BADGER is covered by U.S. Patents 1,735,979 and 1,735,980. See *I.S.J.*, 1930, 166.

Brevities.

Cuban Loan.—It was lately reported that both Houses of the Cuban Congress had ratified the loan of $80,000,000 recently negotiated with the Cuban Government by the Chase National Bank of New York.

Liverpool Sugar Exchange.—The Liverpool Sugar Exchange, the inception of which is mainly due to Mr. Leslie Fairrie, opened its doors on February 26th. The Standard Futures Contract dealt in is for raw cane sugar *ex* public bonded warehouse, Liverpool, but by arrangements between buyer and seller through the medium of a Delivery Variation Contract delivery can be effected in all the most important centres. Raw beet sugar can also be tendered. Liverpool hopes therefore to provide an ideal hedging market for both cane and beet.

"Maizolith."—As the result of work at the Iowa State College, in co-operation with the American Bureau of Standards, an entirely new type of material, termed "Maizolith," has recently been developed from cornstalks. This material is somewhat like hard rubber in appearance and properties. It has been found easily possible by severe chemical and mechanical treatment to hydrate the cornstalk completely, so that the product is a jelly-like mass with no vestige of fibrous structure. "Maizolith" is prepared by drying this jelly and then machining the finished piece into the desired shape.

Cuban Costs.—In the annual report of the Cespedes Sugar Company, ending October 31st, 1929, one finds the following cost figures in dollars per bag of sugar of 325 lbs., those for 1928 being given at the same time: Cost of cane $2·845, 3·489; dead season expense, 0·485, 0·642; crop expense, 0·742, 0·826; taxes and overhead, 0·207, 0·234; packing, freight, and selling, 1·230, 1·368; giving total expenses of $5·509 and $6·559 for 1929 and 1928 respectively. Deducting this from the income items (sales, proceeds previous crop, molasses sales, etc.), amounting to $7·183 and $8·752, one obtains operating profits of $1·674 and $2·193 per bag.

Colour Analyser.—What is claimed to be a great advance in colour measurement is announced by Dr. Chas. B. Bazzoni, of the University of Pennsylvania.[1] Light reflected from the sample is admitted to a spectroscope, which separates it into its component colours. A selected portion of the dispersed light passes into a photo-electric cell, the very feeble current thus passed being analysed about one million times, this amplified current being indicated on a sensitive galvanometer, the reading of which can be noted or recorded on a photographic film. Different portions of the spectrum are successively admitted to the photo-electric cell until the entire spectrum has been covered, it being possible thus to obtain a complete record of a coloured sample in less than 10 seconds.

Xylose Sugar.—In the xylose experimental factory at Anniston, Ala.,[2] it was found by the Bureau of Standards that the gums and ash must first be removed from the cottonseed hull bran. This is accomplished by washing the bran with cold water, followed by cold, very dilute sulphuric acid. Treatment with hot dilute sulphuric acid hydrolizes certain constituents of the bran to form xylose, which dissolves the acid. The solution is then partially neutralized with calcium carbonate treated with carbon to remove the yellow colouring matter, filtered, and evaporated to a rather thick consistency. When this solution is cooled, xylose crystallizes out. There is at present no market, however, for this 6-carbon sugar, and the Bureau are sending out samples asking for suggestions for its profitable utilization.

Sugar as Food.—Dr. Donald A. Laird, Director of the Colgate University Psychological Laboratory, in reporting the outcome of a series of experiments to determine the best means of counter-acting mental and physical fatigue, declares that the secret of recovering mental poise and physical energy is to take more sugar in tea or coffee. He asserts that in almost every mental and physical test it was found that sugar helped the subject to recover mental and motor control after exercise. Sugar, instead of being fat-forming, he declares, builds up energy.

[1] *Chemicals*, 1930, **33**, No. 4, 22. [2] *I.S.J.*, 1929, 160.

Jamaica Production Costs.—H. H. Cousins in reporting the results of a questionnaire circulated to Jamaica factories for the purpose of collecting statistics for the Olivier Commission publishes the following figures; Cane costs per ton of sugar produced (19 factories) from £6 to nearly £19; manufacturing costs per ton of sugar (fuel, repairs and overhead, but not rum making costs), from £3. 7s. 4d. to £6. 10s. 8d., one factory reporting as high a figure as £13. 1s. 7d. Total costs, including interest on mortgages, ranged from £11. 3s. 2d. to £18. 1s. 11d.

Beet Factory Effluents.—An important statement on the attitude of the Ministry of Agriculture towards the question of river pollution by the effluent of the British beet factories was made lately at the annual meeting of the National Association of Fishery Boards, by Mr. H. G. Maurice, Fisheries Secretary of the Ministry. He announced that the Department was satisfied that excuses no longer exist for the pollution of rivers by factories, and indicated that in future offenders will receive from official quarters no consideration that can be legally withheld.

Molasses as Fuel.—About 30 per cent. of the molasses produced in Queensland during 1928 was burnt as fuel in the bagasse furnaces.[1] All the Northern mills reported that this could be done without serious difficulty, but some of the other mills had to abandon the attempt owing to clinkering. This seems to be due to the nature of the ash itself. Experiments carried out in Java in 1923 showed that when burning molasses alone it was possible to evaporate 2 lbs. of water by burning 1 lb. of this by-product of 89·5° Brix in a special furnace, the boiler efficiency of which was 50 per cent.

New Colorimeter.—Operation of the new Toussaint Photo-electric colorimeter for the determination of the composition of the colour of solids and liquors for the comparison of colours depends on the action of a photo-electric cell, which consists essentially of a glass bulb containing argon at a low pressure, and having on its inner surface a layer of potassium. There is hung inside the bulb at a short distance from the potassium, a tungsten ring. The tungsten terminal is connected to the positive pole of a battery, and the potassium terminal to the negative pole. In the circuit thus formed a galvanometer is inserted. When a beam of light is directed on the cell, the galvanometer acts as a very delicate and exact photometer. It therefore entirely eliminates visual errors. It can be used for the estimation of the "whiteness" or for the measurement of sheen or gloss.

Improving on POJ 2878.—The possibility of obtaining a variety better than POJ 2878 is now being studied by the Cane Breeding Division at Pasoeroean, Java. They are aiming at producing a new type of Kassoer by crossing a third or fourth nobilized cane back with Glagah (the wild cane *S. spontaneum* of Java); and to cross the new type Kassoer back again with a nobilized cane. Dr. Bremer, the cytologist of the Experiment Station, is throwing a flood of light on the mechanism of the nobilization process, and assisting in the evolution of a cane with all the good points of 2878 plus resistance to root rot and other diseases, a larger cane and therefore a heavier yielder. So far only one cane of this order has been obtained, 2952, the offspring of 2722 and S.W. 499, that is, the product of a fourth nobilization. This is the only variety that is now being spread to the factories for comparison with 2878 in field trials, and the results are awaited with interest.[2]

Registration of Chemists.—At the last annual general meeting of the South African Sugar Technologists' Association it was proposed that the Association should keep a register of sugar chemists who have qualified by holding a degree or diploma of a recognized College or University, by being an A.I.C. or an F.I.C., or by having had five years' experience in a sugar laboratory, and also having passed the final examination of the City & Guilds of London Institute. After discussion as to the best means of putting this desirable aim into operation, it was resolved by the meeting that "a Register of Chemists be kept by the Association; that the council form a sub-committee to draw up qualifications for the register; and that the South African Institute of Chemists be approached with the wish that they advise the council on the matter of qualification."

[1] *Aust. Sugar J.*, 1930, 21, No. 10, 613.
[2] Manuel L. Roxas in *Reports of the 7th Convention of the Philippine Sugar Association*, 1929.

Review of Current Technical Literature.[1]

ANNUAL SYNOPSIS OF PHILIPPINE MILL DATA, 1928-29. E. T. Westley. *Annual Reports of the 7th Convention of the Philippine Sugar Association*, 1929.

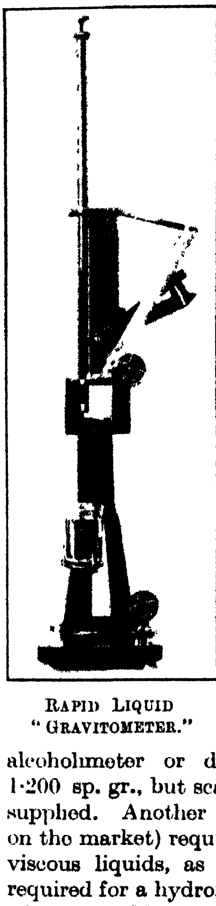
This year's synopsis covers the work of 18 factories, one more than last year, the new factory reporting being Danao. 4,871,118 metric tons of cane were milled, resulting in 554,847 metric tons of sugar polarizing 96·66, by far the biggest crop ever taken off in the Philippine Islands. The average quality of the cane for all the islands is lower than the previous year. This poorer quality of cane is reflected in the 1·80 average piculs of sugar per ton cane for 1928-29 against the 1·83 average of the previous year. The best average quality of cane for any one season was the 1922-23 season when 1·94 piculs of sugar was made from every ton of cane. With that quality of cane the 1928-29 crop would have been 681,956 piculs of sugar larger than it was. The rate of milling was speeded up in most of the factories during the last season and the general average was 83·58 metric tons cane per hour, 3·5 tons more per hour than the previous season. The average tonnage fibre ratio for 1928-29 is considerably lower than last year. The average extraction for 1928-29 was exactly the same as for the previous season, as were milling losses and extraction ratio. The seventeen factories reporting last year show slightly better work this year but the figures from Danao bring the general average even. This must be considered very good work as the dilution last season was only 11·50 against 13·18 average during the previous year, and also keeping in mind that the rate of milling was faster in 1928-29. Comparing the milling in Java with the milling in the Philippines it is safe to say that the Philippines lead by a wide margin both in regard to quantity and recovery. Experience has shown that proper preparation of the cane, deep grooving together with Messchaert grooves is principally responsible for this; the next step no doubt lies in a more efficient way of applying maceration.

Judging boiling house work from the rise in purity from mixed juice to syrup an improvement is noted over the 1927-28 results; the average increase in 1928-29 was 1·31 against 1·16 for the previous season. This is a step in the right direction but there is still room for greater improvement. The lime used in 1928-29 averaged 0·77 kilo, CaO per ton cane against 0·69 during 1927-28; and this increase in lime no doubt helped to improve the clarification. The 1928-29 figure of 2·11 is the highest average press-cake per cent. cane reported in any one year. The larger amount of lime used is no doubt responsible for part of this increase, but part is also due to the floods in Negros during the early season. The average polarization of press-cake dropped in 1928-29 to 4·73 from 4·86 in 1927-28. The average moisture in press-cake was 67·70 per cent. and is the highest so far reported in any one year. Judging from the average figures, practically the same grade of sugar was turned out in 1928-29 as during the previous crop, slightly favouring the 1928-29 sugar. The average polarization was 96·66, the highest so far reported. The 0·78 figure for moisture in 1928-29 is 0·01 lower than the previous crop and is also a record for low moisture in any one crop. We also see that the moisture ratio is down to a new level of 23·35 for 1928-29 against 23·58 during 1927-28. Clarity and per cent. ash figures are also better than ever before, with 44·98 mm. for clarity and 0·30 per cent. ash as average figures for 1928-29. 37·18 gravity purity of final molasses is the average figure for 1928-29, or slightly higher than the 37·15 average for 1927-28. The lower initial purity of the 1928-29 juices, and the faster rate of operating is no doubt the reason that no greater improvement is shown at this station. The average overall recovery for 1928-29 was 85·69 or a drop of 0·43 from the 86·12 average in 1927-28. Factors responsible for this drop are lower initial purities, slightly higher final molasses, and faster rate of operating. Better chemical control may also have something to do with this drop. As the milling figures are the same for both the last crops, the drop in recovery falls on the boiling house work. In addition to the factory data summarizing the figures commented upon above, tables are presented giving the following information: Milling plant figures (equipment, sizes, mill openings, speed, pressure, etc.); cane varieties milled (Negros Purple, 47·4; Badilla, 10·0; unrecorded, 28·0 per cent.); composition of cane by islands; classification of centrals in order of milling loss; tonnage fibre ratio; per cent. molasses produced on theoretical; boiling house

recovery; summary of losses; time balance (delay due cane amounted in two cases to 15·2 and 23·1 per cent.); and capacity standards (to be borne in mind when judging work done by different factories here reported).

GRAVITOMETER METHODS OF DETERMINING THE DENSITY OF LIQUIDS. **W. A. Benton.** *Journal of the Society of Chemical Industry*, 1929, **48**, No. 48, 1145-1152.

A simple modification of a "gravitometer" originally designed for solids but now adapted to liquids has recently provided an instrument which is free from the features generally objected to in hydrometers. It completely eliminates—for all practical purposes—surface-tensional troubles. It is provided with an indicator of the graduated bar type, very easily read, and capable of being observed with extreme precision through a lens. One instrument covers an extensive range, equal to that of 10 or 12 high-class hydrometers. It is not fragile, and should have an indefinitely long life as an accurate instrument. No parallel rule is used, since, when once the instrument has been adjusted for the prevailing temperature, it is only necessary to weigh the density bulb in the liquid under examination and set the slide carrying the pivoted indicator so that its pivot is in line with the disc pointer of the spring resistant. An accurate estimation can be made in from 20 to 25 secs. Perhaps the most valuable feature of the instrument is that, in ordinary use, the observational accuracy is practically identical with the actual instrumental accuracy. The standard instrument, covering a range from 0·650 to 2·300, is marked to 0·005 in sub-divisions $\frac{1}{32}$th of an inch, or 0·794 mm. wide. It can easily be read to 0·001 sp. gr. (0·15°Bé., or 0·25°Brix.). But a modified form of the instrument adapted to give a much more open scale over the densities more frequently met with is marked to 0.001 in sub-divisions $\frac{1}{64}$th of an inch wide. The reading lens enables an accuracy of 0·00025 (0·04°Bé. or 0·06°Brix) to be obtained. In actual use it is believed this instrument will prove more reliable and more easy to read than any commercial type of alcoholmeter or densimeter yet produced. It is graduated from 0·650 to 1·200 sp. gr., but scales as Bé. or Brix to suit sugar industry requirements can be supplied. Another point is that the new instrument (which will shortly be placed on the market) requires a relatively small volume or sample; and that in the case of viscous liquids, as molasses, a reading can be obtained in a fraction of the time required for a hydrometer. Further particulars will be published of this instrument when available.



RAPID LIQUID "GRAVITOMETER."

MIXTURES OF ALCOHOL WITH OTHER FUELS FOR INTERNAL COMBUSTION ENGINES. **J. G. King[1] and A. B. Manning.** *Journal of the Institution of Petroleum Technologists*, 1929, **15**, No. 74, 350-368.

In order to obtain the greatest efficiency from alcohol in an internal combustion engine, a much higher compression would be necessary than that for which existing engines are designed. But by mixing it with other liquid fuels, a mixture is obtained that can be employed successfully in engines of present construction. Its miscibility with these other liquid fuels is therefore a matter of importance. Absolute alcohol is miscible in all proportions with petroleum spirits, but with industrial alcohol of 95 per cent. by volume the miscibility will depend on its water content

1 Chief Chemist, Fuel Research Station, Department of Scientific and Industrial Research, London

and its temperature. The addition of benzol in suitable proportions to the alcohol-petrol mixture ensures a stable solution under all but extreme cases, and the combination of the three liquids gives a valuable fuel. In this paper the authors describe experiments designed to indicate the limiting factors in the preparation of such fuels. In making the mixtures, the proportions in the mixture which just failed to show opalescence were taken as the critical proportions for that temperature. It was found that the ranges of miscibility at 15°C. of 95 per cent. alcohol with petrol extend from 0 to 1·1 per cent., and from 63·5 to 100 per cent. of alcohol by volume. Absolute or 98·6 per cent. alcohol, on the other hand, is miscible in all proportions with petrol. On the addition of water to the mixture, petrol separates until at a certain concentration none remains in solution. Addition of even so small a quantity as 1·8 per cent. of water is sufficient to cause marked separation in a mixture of absolute alcohol and petrol. Coming now to ternary mixtures, the limits of miscibility of alcohol and benzene with B.P. No. 1 spirit are here shown :—

Quality of Alcohol and Benzene used.	Mixtures containing 45 per cent. petrol. Alcohol Per Cent.	Benzene Per Cent.	Mixtures containing 40 per cent. petrol. Alcohol Per Cent.	Benzene Per Cent.
Pure alcohol and	16·00 (1)	39·0	14·50 (1)	45·5
pure benzene	39·50 (2)	15·5	48·00 (2)	12·0
Pure alcohol and 90's	18·00 (1)	37·0	15·50 (1)	44·5
benzol	39·00 (2)	16·0	47·00 (2)	13·0
Pure methylated spirit and	19·00 (1)	36·0	17·50 (1)	42·5
pure benzene	39·00 (2)	16·0	47·50 (2)	12·5
Power methylated spirit and	22·50 (1)	32·5	18·00 (1)	42·0
90's benzol	36·00 (2)	19·0	47·00 (2)	13·0

1 Minimum amounts of alcohol or spirit necessary.
2 Maximum amounts of alcohol or spirit necessary.

Lastly, the results of engine tests are recorded, some of the conclusions being : Petrol-alcohol mixtures cannot be used satisfactorily on a standard petrol engine ; and it is very difficult to start from cold with these, even after priming with petrol. Petrol-alcohol-benzol mixtures are quite suitable for use in a petrol engine without any alterations being made beyond enlarging the carburettor jets.

COMPOSITION AND AGRICULTURAL VALUE OF FACTORY MUD (PRESS-CAKE). **Frank W. Broadbent.** *Reports of the Association of Hawaiian Sugar Technologists*, 1929, 197. In certain factories in Hawaii the defecation settlings are run through Kopke centrifugals, dropped into mixers, water added to give about 14 per cent. solids, and this free-flowing mixture run into tank cars and sent to the fields. One company thus distributed 20,380 tons of this liquid mud, containing 2853 tons of solids, which contained 11·33 per cent. lime (CaO), 1·85 per cent. nitrogen (N), 8·89 per cent. phosphoric acid (P_2O_5), and 0·37 per cent. potash (K_2O). Applying 2853 tons of dry matter on 575 acres gives an average rate of 4·96 tons per acre. Calculating from the per cent. analysis, this amounts to an average of 1124 lbs. of CaO; 184 lbs. of N; 882 lbs. of P_2O_5, and 37 lbs. of K_2O per acre. The immediate agricultural value of these plant nutrients would depend upon their availability. Be this what it may, it is interesting to figure the cost of the above-mentioned lime, nitrogen, phosphoric acid and potash if purchased on the market. A ton of mud solids contains 227 lbs. of CaO, worth $4·10 ; 37 lbs. of N, worth $4·80 ; 178 lbs. of P_2O_5, worth $5·50; and 7½ lbs. of K_2O, worth $0·30, making the total value of $14·70. The average daily tonnage of mud of 86 per cent. water content was 111·4, which works out at 0·0403 tons of wet mud per ton of cane ground or 1·51 cub. ft. of mud per ton of cane.—DETERMINATION OF REDUCING SUGARS USING CUPRO-POTASSIUM CARBONATE SOLUTION. **H. A. Schuette and J. N. Terrill.** *Journal of the Association of Official Agricultural Chemists*, 1930, 13, No. 1, 93-98. In an attempt at an experimental verification of the statement that a modified Soldaini-Ost cupro-carbonate solution can be made to show a selective reactivity towards levulose in the presence of dextrose, the observation was made that there exists an apparently unsuspected source of error in the use of certain sugar-

oxidising reagents of this type. This was found to be true when these reagents were used for the gravimetric determination of levulose. The error in question is due to the formation, in part, of colloidal cuprous oxide, which remains dispersed in the filtrate for approximately 24-28 hours, depending upon the concentration of the copper sulphate in the reagent that was used.—DEFECATION CONTROL BY THE H-ION METHOD. **J. H. Pardo.** *Facts about Sugar*, 1930, **25**, No. 9, 220. Prior to the introduction of *pH* control in a factory in Peru, the juice was limed to a "slight alkalinity" using some test-paper, which point was found to be about 7·2 *pH*. On putting the colorimetric method of H-ion control into use, it was found that the juice clarified best when limed to 8·0 to 8·2 *pH*, but, as this high alkalinity considerably delayed the time of settling, liming was reduced to 7·8 *pH*. Whereas with the old method of control there had been a fall between clarified juice and syrup, now after instituting the *pH* method this was changed into an increase. There was a reduction of inversion losses, and the rate of filtration was increased. The only inconvenience was an increase of about 20 per cent. of press-cake due to the greater precipitation of impurities from the juice, and to the larger amount of lime necessary. It was observed that there was a direct relationship between the P_2O_5 content and the optimum *pH* content of the juice. Indicator mostly used was phenol red.—DETERMINATION OF SUGAR IN MOLASSES FROM UBA CANE. **E. Haddon.** *S. A. Sugar J.*, 1929, **13**, No. 12, 833. Undetermined losses returned by some factories in East Africa amount only to 0·7 per cent. of sucrose in cane. This points to the presence of optically-active substances in the molasses, probably dextrins hydrolysed from the starch known to be present in Uba cane juices,[1] and a specially preliminary treatment as the following becomes necessary : 121 c.c. of a 20 per cent. solution of the molasses, plus 2 grms. of baryta, are boiled over a reflux condenser for about 20 min., cooled, acidified with 1 c.c. of glacial acetic acid, and made up to 200 c.c.; this liquid is clarified with dry basic lead acetate, and filtered ; to 100 c.c. of the filtrate are added 5 c.c. of 50 per cent. ammonia, made up to 110 c.c., and again filtered ; to 50 c.c. of the clear filtrate (from which the dextrin has now been eliminated) 2·5 c.c. of glacial acetic acid are added, and the volume completed to 55 c.c. This liquid is then polarized before and after inversion. If both polarizations are identical, all optically-active impurities have been precipitated or destroyed. Uba molasses (average of 21 samples) gave the following : Brix, 90·42 ; sucrose by Clerget, 42·06 : purity (using Clerget sucrose), 46·51 ; sucrose, by above baryta method, 37·56 ; purity (using this sucrose value), 41·47.—ETHYL ALCOHOL INDUSTRY (IN THE U.S.A.). **Gustave T. Reich.** *Chem. & Met. Eng.*, 1929, **36**, 716-719. Alcohol distilleries in the U.S.A. are adopting more and more up-to-date equipment to reduce their costs and are striving to eliminate waste by recovering products from their slops. Barbet or Guillaume stills represent a high type realizing great fuel economy, the steam consumption being 35-38 lbs. per gallon of 190° proof ethyl alcohol, while semi-continuous stills require 42-45 lbs. Economy is achieved by the application of various heat exchangers. In a process invented by the author,[2] the recovery of the alcohol and the concentration of slop proceeds simultaneously. Mention is made of the manufacture of absolute (water-free) alcohol by the use of azeotropic mixtures practised on a large scale by the U.S. Industrial Alcohol Company.—AVAILABLE ALKALINITY (ACTIVE LIME) IN COMMERCIAL LIME. **C. M. Jovellanos.** *Philippine Journal of Science*, 1930, **41**, No. 1, 71-74. In the method specified by the American Society for Testing Materials, the end-point is indefinite, due to the impurities present (silica, iron and alumina),[3] and the following procedure is advised : 1-1·5 grm. of the sample (powdered to pass a 100 mesh sieve) is placed in a 1 litre flask with 600-700 c.c. of recently-boiled distilled water, the contents being boiled for 4-5 mins. After cooling and adding a few drops of phenolphthalein, the liquid is titrated with N/10 acid, which is run in drop-by-drop with constant stirring almost to decolorization. Small lumps present are crushed with the flattened end of a glass rod. Then the flask is closed, allowed to stand for half an hour, and titrated until colourless for one minute, its CaO content being finally calculated.

J. P. O.

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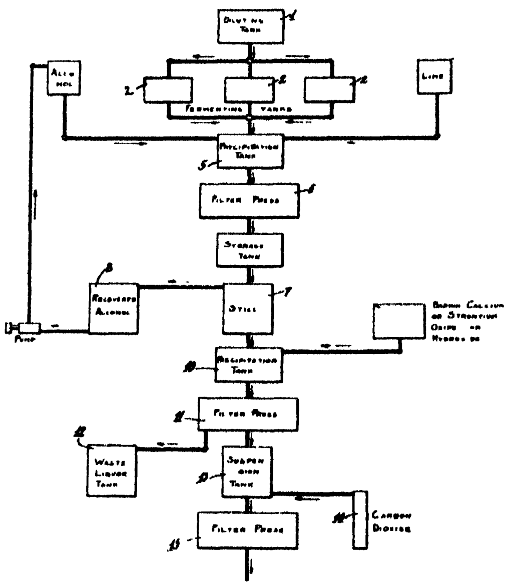
1 *I.S.J.*, 1928, 442, 446, 503. 2 U.S. Patent, 1,599,185; *I.S.J.*, 1927, 51.
3 During the calcination of the limestone, these impurities combine with lime and form compounds which slowly hydrolyse in water.

Review of Recent Patents.[1]

UNITED STATES.

RECOVERY OF SUGAR FROM CANE MOLASSES.[2] **Holger de Fine Olivarius (assignor California Packing Corporation,** of San Francisco). 1,730,473. October 8th, 1929.

Referring to the drawing it is preferred to first eliminate the invert sugar content of the molasses from which the sucrose is to be recovered and for that purpose the molasses is mixed with water in a diluting tank 1 and the mixture passed to ferment tanks 2. Yeast is added to the mixture in the tanks 2 for the purpose of converting the invert sugar content of the molasses to alcohol and carbon dioxide, etc. If a relatively highly concentrated mixture of molasses and water be employed, special yeast need not be employed and ordinary yeasts will all function satisfactorily, the usual conversion taking place without substantial loss of sucrose due to the inverting action of the yeasts. A concentration of approximately 65° Brix is well suited. After fermentation the mixture is passed from tanks 2 to a precipitating tank 5 and alcohol together with lime or other earthy metal oxides or hydroxides are added to the mixture in proper proportion to precipitate preferably substantially all of the interfering organic bodies such as gums, waxes, etc., and colouring matter, in the mixture without precipitating any substantial portion of the sucrose. The mixture is then passed from the precipitating tank 5 to a filter-press 6 for the separation of the precipitated bodies from the filtrate containing the sucrose.



The process to this point does not differ from that described in a former patent specification[3], except as to the concentration employed and the fact that with proper concentration it is unnecessary to use specially adapted yeast, but with the prior practice it has been considered necessary to retain the alcoholic character of the filtrate in the subsequent precipitating action to follow. Where certain earthy metals are employed as precipitating agents the filtrate discharged from the filter-press 6 may be passed through a still 7 and the alcohol there separated and recovered in a suitable chamber 8. The alcohol may be re-used by pumping it back to the precipitating tank 5. The molasses from which the interfering bodies such as invert sugar, gums, colouring matter, etc., have been removed, is passed to a precipitating tank 10 where an earthy metal oxide or hydroxide is added in proper proportion to precipitate its corresponding saccharate. The mixture from the precipitating tank 10 is then passed to a filter-press 11, and the saccharate filtered from the waste liquor, the latter passing to tank 12. The saccharate is passed from the filter press 11 to a suspension tank 13 and is there treated with carbon dioxide from a suitable source of supply 14 to decompose the saccharate into its corresponding carbonate and free sucrose. The mixture of carbonate and sucrose is then passed to a

[1] Copies of specifications of patents with their drawings can be obtained on application to the following—*United Kingdom*: Patent Office, Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2 (price 1s. each). Abstracts of United Kingdom patents marked in our Review with a star (*) are reproduced from the *Illustrated Official Journal (Patents)*, with the permission of the Controller of H.M. Stationery Office, London. Sometimes only the drawing or drawings are so reproduced. *United States*: Commissioner of Patents, Washington, D.C. (price 10 cents each). *France*: L'Imprimerie Nationale, 87, rue Vieille. du Temple. Paris. *Germany*: Patentamt, Berlin, Germany. [2] See also *I.S.J.*, 1930, 53. [3] U.S.P., 1,401,433; *I.S.J.*, 1922, 219.

filter 15 for separation and the filtrate (sucrose) thereupon evaporated, decolorized and crystallized by well known methods. Where calcium oxide or hydroxide is employed as a precipitating agent for sucrose from a non-alcoholic solution the best results are obtained by employing a temperature not exceeding 20°C. Where barium and strontium are used as the precipitating agents, the best results are obtained by precipitating the saccharate at a boiling temperature.

PRODUCTION, APPLICATION AND REVIVIFICATION OF ACTIVATED (DECOLORIZING) CARBON. (*A*) **Edouard Urbain,** of Paris (assignor to the **Urbain Corporation,** of Delaware, U.S.A.). 1,735,096. November 12th, 1929. (*B*) **Stanley Hillier,** of San Jose, Cal. 1,735,392 and 1,735,395. November 12th, 1929. (*C*) **Arthur B. Ray** (assignor to **Carbide and Chemicals Corporation,** of New York). 1,735,061. November 19th, 1929. (*D*) **Franz Mik,** of Kreuzlingen, Switzerland (assignor to the **Holzverkohlungs-Industrie A.-G.,** of Constance, Germany). 1,743,975. January 14th, 1930. (*E*) **Charles N. Whitaker,** of Wilmington, Cal., U.S.A. 1,744,429. January 21st, 1930.

(*A*) The process of producing active carbon which comprises permeating vegetable material or the like with a mixture of phosphoric acid and sulphuric acid, heating and calcining in a substantially closed vessel allowing the escape of gases at a temperature high enough to cause the phosphoric acid to decompose with the formation of phosphides. (*B*) The specifications relate to apparatus for heating and distilling carbonaceous materials, and for pulverizing and drying solids. (*C*) A process of forming strongly coherent bodies from highly absorptive carbonaceous material without substantially impairing the absorptive capacity of the same comprises associating such material in fragmentary condition with a substance yielding carbon on thermal decomposition, moulding the resulting mixture under pressure, applying regulated heat to decompose said substance, and treating the coherent body thus formed with a gaseous oxidizing agent to increase its absorptive capacity. (*D*) Claim is made for a highly activated charcoal produced from hard wood in the condition of white rot. (*E*) A charcoal reactivator comprising : an outer shell providing a closed treating chamber; an upright basket shell supported near its top in and by the first mentioned shell and laterally spaced therefrom, said basket shell having openings communicating with said treating chamber; a cover for and secured to the top of said basket shell; a lower plate secured to the bottom of said basket shell and closing the lower extremity thereof; a steam inlet pipe extending through said lower plate; upper and lower perforated screen members supported in said basket shell, the lower screen at a substantial distance from the bottom of the basket shell and both screens extending horizontally across the chamber of the basket shell and spaced from each other, and providing a charcoal chamber therebetween, each of said screen members comprising a screen plate placed between two slotted plates; and means for removing steam from said treating chamber.

MANUFACTURING WHOLE JUICE SUGAR. **Milton S. Hershey,** of Hershey, Pennsylvania, U.S.A. 1,740,693. December 24th, 1929.

In practising this process, the inventor finds it preferable to fill a vacuum pan nearly full with the raw clarified sugar juice and without addition boil the mass down rapidly until it reaches a density where it cannot be removed without pressure from the pan and it reaches the thickest possible density where it can be economically and practically removed under pressure from the pan. The boiling is preferably effected between temperature ranges varying from 125 to 145°F., and at pressures varying from 23-27 in. The essential part of the process lies in the removal of the boiled juice at a critical point in the boiling, and subsequent agitation to convert the boiled mass into crystalline form. This critical point is determined by the operator who frequently removes "proofs" from the pan when the last "proof" removed has a consistency such that it may be rolled as a ball between the operator's fingers and will retain its shape. When the boiled mass reaches the critical stage of density, it contains about 9 or 10 per cent. of moisture and has about arrived at the limit

where it can be freely removed from the pan by a 10 lb. air pressure, and all the sucrose of the mass crystallizable under these conditions is crystallized. If the boiled juice were left in the condition it emerges from the vacuum pan, it would harden into a dense concrete mass. To convert the boiled juice into its crystalline sugar form, it becomes necessary to subject it to a further drying and separation process, outside the pan. In manufacturing on a large scale, about ten tons of the boiled juice are dropped into a conveyor of suitable type and the boiled juice agitated during its passage from one end to the other of the conveyor. During the passage of the boiled juice through the conveyor, an air blast which may be heated is delivered on to the agitated juice. The bottom and sides of the conveyor are water-jacketed and may be heated to hasten the drying process, the speed of operation of which will obviously depend upon the rate at which the boiled mass is fed through the conveyor, the temperature and hygrometric state of the air blast; and the temperature of the conveyor jacket. These are factors which may be varied within wide limits by persons skilled in the art in accordance with variations of the scale of manufacture and climatic conditions of the location of the plant. The boiled juice dropped from the vacuum pan enters the conveyor at one end as a thick liquid mass at practically its limit of fluidity and emerges from the other end of the conveyor, as a mealy crystalline sugar having crystals so fine as to be almost imperceptible. There is no division of syrup from sugar in the mass discharged from the vacuum pan; the whole mass is converted from a mass of very dense liquid into a free flowing and extremely finely divided solid, without by-product of any kind whatsoever, and adapted without further mechanical treatment for domestic and manufacturing uses. (This application is a continuation-in-part of co-pending United States application, Serial No. 208,658, filed July 26th, 1927, which is, in turn, a continuation-in-part of abandoned applications, Serial Nos. 162,922 and 91,820, filed January 22nd, 1927, and March 2nd, 1926, respectively.)

MANUFACTURING ABSOLUTE ALCOHOL. **Eloi Ricard** (assignor to **U.S. Industrial Alcohol Co.**, of New York). 1,744,503-1,744,504. January 21st, 1930. A process for the manufacture of absolute alcohol from aqueous alcohol, comprising the mixing together of aqueous alcohol, benzene and gasoline the latter two in sufficient quantity to remove substantially all the water from the alcohol, and the benzene and gasoline also serving as entraining bodies to form with the alcohol an azeotropic mixture containing water when distilled having a minimum boiling point, and in which the mixture is subjected to distillation in such manner as to obtain absolute alcohol as a residue, the said gasoline having been distilled between 100 and 102°C.—FERMENTATION PROCESS. **William L. Owen** (assignor to the Citizens of the United States). 1,744,001 January 14th, 1930. A fermentation process comprises the propagation of yeast culture, the Brix of the wort being reduced 50 per cent., the transfer of the seed to a seed vat that contains 5 per cent. by volume of a vegetable carbon based on the volume of the wort to be fermented, the holding of the seed yeast in the seed vat for approximately thirty minutes, the addition thereafter to the seed vat of freshly sterilized wort, the fermentation of the entire contents of said seed vat until the density thereof is reduced to one-half of its original density, the subsequent transfer of the contents of the seed vat to a fermenter which is operated at 30-40° Brix until fermentation is complete.—CONTINUOUS SETTLING APPARATUS. **Samuel I. Bousman**, of Denver, Colo. (assignor to **The Dorr Co.**, of New York). 1,741,498. December 31st, 1929. Apparatus for sweeping a peripheral zone of a non-circular area includes: a sweeping member, means for guiding the outer end of the member along the periphery of the area, a support on which the inner end of the member is mounted by means permitting reciprocation of the member relative to the support, and means for driving the member.—CANE HARVESTER. **Isaac H. Athey**, of Chicago, Ill. 1,741,602. December 31st, 1929. A cane harvester comprises: a transversely extending transmission housing, a traction element at each end of and supporting said housing, a frame member extending rearwardly from each end of said housing, a plurality of parallel, spiral conveyors disposed in a substantially horizontal plane and rotatably mounted on one of said frame members, said spiral conveyors comprising leaf stripping means, and means carried by said transmission housing for severing

cane stalks from the roots thereof and delivering said cane stalks to said spiral conveyors in a direction substantially at right angles to the axis of rotation of said spiral conveyors.

UNITED KINGDOM.

CONFECTIONERY. (*A*) **M. M. Guggenheim, Baker Perkins, Ltd.,** and **Anciens Etabl. A. Savy, Jeanjean & Cie, Soc. Anon.,** of Paris. 323,004. September 17th, 1928. (*B*) **C. B. K. Boggild and M. Jacobsen.** 323,084. November 8th, 1928. (*C*) **J. W. and F. W. Greer.** 323,299. October 27th, 1928.

(*A*) Anti-tailing devices for chocolate coated goods comprise means whereby the tails are engaged and carried away laterally. (*B*) Cast articles of chocolate or like fragile materials, falling from a mould belt in a cooling chest, are received on a rapidly-moving belt to avoid risk of one falling on and damaging another. The belt delivers the articles to channels, trays, or a slow belt. Vibrating rails, as described in Specification 266,667, may be used to shake off the articles. (*C*) A machine for conveying confectionery and particularly for conveying freshly coated confections through a cooling chamber comprises a series of moving trays, means for removing the plaques in succession from the trays and for loading them while they are away from the trays, and means for advancing the loaded plaques over a supporting surface towards the trays and for placing them upon the trays.

TUBE-PLATES OF CALANDRIA EVAPORATORS. **W. J. Blanchard,** of Pall Mall, London. 322,280. October 9th, 1928. In an evaporator of the calandria type the holes in the upper tube-plate are countersunk until the adjacent countersinks meet, or nearly meet, thereby forming surfaces sloping towards each hole such that solid material cannot lodge thereon. The tube-plate may be made thicker than normal to accommodate the countersinks.—FIBROUS CELLULOSE. **J. J. de la Rosa,** of Tuinucu, Cuba. 322,763. June 30th, 1928. In the production of cellulose from sugar cane fibre, the fibre is treated with a dilute solution of sulphurous acid, e.g. an aqueous solution containing 4-5 per cent. of sulphur dioxide, in order to inhibit the growth of fungi and spontaneous injury to the fibre. Preferably the fibre is crushed and washed in hot water before treatment with sulphurous acid while the succeeding alkaline treatment may follow immediately or the material may be stored for several months according to circumstances. Subsequent to the acid treatment, the fibre is washed in hot water and treated with a dilute solution of potassium or sodium hydroxide under pressure at from 140-170°C. It is finally washed and bleached. Alternatively, the alkali may be at atmospheric pressure and below 100°C., the fibrous material being subsequently beaten in a pulping engine.—PRODUCTION OF FUSEL OILS FROM MOLASSES, ETC. **J. Y. Johnson** (communicated by the **I. G. Farbenindustrie A.-G.,** of Frankfort-on-Main, Germany). 322,029. September 19th, 1928. Sugar solutions (using say molasses) are purified, e.g. by precipitating water-insoluble phosphates such as calcium phosphate in the solution to be purified, the phosphates apparently absorbing the impurities present. Water soluble phosphates such as KH_2PO_4, $(NH_4)_2HPO_4$, Na_2HPO_4, or mixtures thereof, may be added to increase the fermentative power of the bacteria. In an example, crude peat is heated with raw phosphate and sulphuric acid and neutralized with chalk and lime. The precipitate is filtered off and the filtrate is treated with diammonium phosphate and a pure culture of *Bacillus butylicus* preferably grown in peat-sugar solution. When fermentation is complete the liquid is distilled giving a mixture of butyl- and isopropyl-alcohol and acetone. (Provisional Specification refers to Specification 318,649).—SACCHARIFICATION OF CELLULOSE. **Soc. Anon. des Distilleries des Deux-Sèvres,** of Mello, France, 323,693. April 3rd, 1929. In the process of the parent Specification both the formylation of the cellulosic material and the hydrolysis of the cellulosic ester formed are effected by employing vapours of anhydrous or highly concentrated formic acid for the former operation and vapours of hydrated formic acid or of a more or less dilute formic acid (for example, with vapours of the maximum boiling point mixture of water and formic acid) or steam for the latter operation.

United Kingdom.

IMPORTS AND EXPORTS OF SUGAR.

IMPORTS.

	One Month ending March 31st.		Three Months ending March 31st.	
Unrefined Sugars.	1929. Tons.	1930. Tons.	1929. Tons.	1930. Tons.
Poland	518	1,704	26,698	7,198
Germany	1,823	3,857	2,629	3,857
Netherlands	....	....	....	....
France	....	....	....	....
Czecho-Slovakia	3,378	....	4,901	516
Java	14,943	....	67,030	....
Philippine Islands	....	....	....	....
Cuba	19,945	19,822	80,615	67,128
Dutch Guiana	....	....	....	....
Hayti and San Domingo	22,027	31,307	25,514	41,592
Mexico	....	....	....	....
Peru	11,707	7,708	48,627	33,002
Brazil	1,180	9,399	9,720	31,802
Union of South Africa	569	38	17,684	14,042
Mauritius	44,880	15,216	132,856	71,202
Australia	12,388	16,989	95,198	68,757
Straits Settlements	....	....	....	....
British West Indies, British Guiana & British Honduras	4,179	9,153	8,319	20,390
Other Countries	1,741	1,712	11,603	12,547
Total Raw Sugars	**139,278**	**116,906**	**531,395**	**372,032**
Refined Sugars.				
Poland	....	....	....	....
Germany	....	1	28	69
Netherlands	4,048	1,406	5,891	2,912
Belgium	147	34	395	193
France	....	....	....	....
Czecho-Slovakia	314	1,207	3,221	3,440
Java	....	....	....	....
United States of America	959	533	2,270	2,131
Canada	2	....	6	....
Other Countries	4	49	11	531
Total Refined Sugars	**5,474**	**3,232**	**11,821**	**9,276**
Molasses { Foreign	13,062	60,770	53,797	101,723
Molasses { British	4,077	389	15,739	8,811
Total Imports	**161,891**	**181,297**	**612,752**	**491,842**

EXPORTS.

British Refined Sugars.	Tons.	Tons.	Tons.	Tons.
Denmark	164	43	332	138
Netherlands	....	...	....	....
Irish Free State	2,725	3,925	8,920	9,580
Channel Islands	148	287	280	634
British West Africa	200	62	739	448
Canada	....	....	....	....
Other Countries	7,934	16,737	11,091	33,829
	11,170	21,055	21,363	44,628
Foreign & Colonial Sugars.				
Refined and Candy	106	136	386	424
Unrefined	27	68	136	178
Various Mixed in Bond	....	....	....	....
Molasses	975	155	2,566	324
Total Exports	**12,278**	**21,414**	**24,451**	**45,554**

United States.

(*Willett & Gray.*)

(Tons of 2,240 lbs.)	1930. Tons.		1929. Tons.
Total Receipts, Jan. 1st to March 22nd	462,266	..	876,680
Deliveries „ „	618,952	..	798,278
Meltings by Refiners „ „	610,033	..	661,804
Exports of Refined „ „	14,881	..	24,372
Importers' Stocks, March 22nd	280,585	..	176,633
Total Stocks March 22nd	449,098	..	377,831
	1929.		1928.
Total Consumption for twelve months	5,810,980	..	5,542,636

Cuba.

Statement of Exports and Stocks of Sugar, at February 28th.

(Tons of 2,240 lbs.)	1928. Tons.		1929. Tons.		1930. Tons.
Exports	295,140	..	712,191	..	71,153
Stocks	671,487	..	947,380	..	791,447
	966,627	..	1,659,571	..	862,600
Local Consumption..	11,541	..	15,643	..	7,372
Receipts at Ports to February 28th ..	978,168	..	1,675,214	..	869,972

Habana, February 28th, 1930. J. Guma.—L. Mejer.

United Kingdom.

Statement of Imports, Exports, and Consumption of Foreign Sugar for Three Months ending March 31st, 1928, 1929, and 1930.

Imports.

	1928. Tons.		1929 Tons.		1930. Tons.
Refined......	77,823	..	11,821	..	9,276
Raw	376,528	.	531,395	..	372,032
Molasses ..	54,429	.	69,536	..	110,534
	508,780		612,752		491,842

Exports (Foreign).

	1928. Tons		1929 Tons.		1930. Tons
Refined ..	201	..	386	..	424
Raw	179	..	136	..	178
Molasses	2,228	..	2,566	..	324
	2,608		3,088		926

Home Consumption of Imported Sugar.

	1928 Tons		1929. Tons		1930. Tons.
Refined	81,556	..	11,006	..	8,989
*Refined (in Bond) in the United Kingdom	233,037	..	201	..	555
†Raw	37,945	..	452,527	..	399,862
Total of Sugar	352,538		463,734		409,406
Molasses	1,150	..	2,507		1,842
Molasses, manufactured (in Bond) in United Kingdom ..	22,414	..	1		4
	376,102		466,242		411,252

Stocks in Bond in the Customs Warehouses or Entered to be Warehoused at March 31st.

	1928 Tons		1929. Tons		1930. Tons.
Manufactured from Home Grown Beet	25,450	..	37,450	..	55,200
Refined in Bond	87,450	..	8,750	..	1,750
Foreign Refined	19,500	..	12,300	..	8,300
„ Unrefined	179,150	..	248,600	..	242,900
	311,550		307,100		308,150

* The quantities here shown are exclusive of the deliveries of refined sugar which has been produced from duty paid sugar returned to refineries to be again refined. Sugar refineries ceased working in Bond as from 25th April, 1928

† The quantities here shown include 143,099 tons entered for refining in refineries in the month ended 31st March, 1930, and 372,871 tons in the three months ended 31st March, 1930.

United Kingdom Monthly Sugar Report.

Our last report was dated 7th March, 1930.

Since that date the sugar markets have been under the influence of an instability and uncertainty, consequent upon the precarious position of the single selling agency for the Cuban production.

There has of late been a strong opposition to its continuance and at the last meeting held on 1st April to consider this question only a small majority of the producers saved it from being abolished. The question is again to be discussed at a meeting at Havana on the 14th instant.

The exports from the Island are about a million tons less than during the corresponding period last year, due to the policy of the single seller of not disposing of the production at ruling prices. One effect of this situation has been the fall in prices in the New York Futures market to within ten points of the parity quoted in London for sugar destined for export other than to the U.S. During the month under review Futures for deliveries of the present crop have fallen about 9d. per cwt. in New York compared with 3d. per cwt. in London.

The London market has been under the influence of another unsettling feature, viz., the uncertainty of the conditions of duty to be imposed in the forthcoming Budget on the 14th instant, and until this date has passed and the conditions known business is more or less at a standstill and commitments are reduced to a minimum.

The London Terminal Market registers a decline of about 4½d. for future deliveries, whilst current months show a little change. The latest prices are :—

	MAY	AUGUST	DECEMBER	MARCH
Raw	6s. 9¾d.	7s. 0d.	7s. 2¼d.	8s. 2¼d.
White	9s. 6d.	10s. 0d.	—	—

Business in actual Raws has been restricted. San Domingoes have been done at 7s. 6d. for May shipment, whilst the single sellers price for Cuban sugar for American distribution is 1⅜ c., c. & f. N.Y.

One of the chief features to have been reported recently is the publication of the first estimate of F. O. Licht of the cultivated area for the forthcoming European beet crop as follows :—

	Estimate 1930-31	Actual Sowings 1929-30	Increase Per Cent.
Europe (including Russia)	2,969,000 Ha	2,629,359 Ha	13
„ (excluding Russia)	1,969,900 Ha	1,845,359	6·7

21, Mincing Lane,
London, E.C.3.
8th April, 1930.

Arthur B. Hodge,
Sugar Merchants and Brokers.

THE

INTERNATIONAL SUGAR JOURNAL.

☞ All communications to be addressed to "The International Sugar Journal," 2, St. Dunstan's Hill, London, E.C. 3.

☞ The Editors are not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

The Editors will be glad to consider any MSS. sent to them for insertion in this Journal, and will endeavour to return the same if unsuitable; but they cannot undertake to be responsible for them unless a stamped addressed envelope is enclosed.

No. 377. MAY, 1930. VOL. XXXII.

Notes and Comments.

The Budget and the Sugar Duty.

Mr. SNOWDEN's Budget which was unfolded on April 14th contained no surprises for the sugar industry. He retained the existing sugar duties for revenue purposes, as it was shrewdly anticipated would be inevitable for him, but he hardened his heart against any suggestions that he should increase the sugar preference for Empire imports as a means of additional assistance to the West Indian and Mauritius sugar producers. Actually, in his Budget speech he did not discuss the sugar duties at all, and we have still to wait till the relevant section of the Finance Bill comes up for discussion in the House before we are favoured with Mr. SNOWDEN's comments on the situation. We note that in spite of his sarcastic remarks when in Opposition a year ago about the advantages accorded to the home refiners over imports of foreign refined, he has taken no steps to curtail them.

But as a preliminary to that expected speech, we have had in the House of Lords the last few days a pronouncement from LORD PASSFIELD, the Colonial Secretary, as to the Government's latest views in the matter. He said that a good deal of the alarm of the last few months had been due to the uncertainty as to the retention of the preference; and that uncertainty was now set at rest. He did not minimize the serious position of the colonies, but he thought it was too early yet to talk of their sugar industries ceasing to exist. The danger that they had to face to-day was in the position of those less favourably situated factories and estates which were producing, not at the average of £11. 17s. 6d. per ton, but at £13, £14, or even at £15 per ton. He did not believe that any assistance which this or any Government could give would rescue such factories, unless it was proposed to meet the deficit of every factory in all the islands. He did not say that the Government would sit still and watch the industry crushed out of existence, but they must be given a little time to consider the problem.

It is of course the case that the Labour Government's difficulties in this matter are only part of their general difficulties in coping with the unemployment problem at home. They are being urged even by trade union leaders to provide protection to home industries against the production of foreign labour, often grossly underpaid. But they hesitate to abandon the arm-chair theories of a lifetime and they are saddled with a Finance minister who is a

rigid Cobdenite. If they cannot or will not apply to the harassed industries at their door the principles of preference, it is not surprising if they are unwilling, till they are positively driven to it, to adopt further protectionist measures in aid of an overseas industry. If there are inefficient factories in the colonies, well! there are similar ones at home, say the Government. And for neither have the Government any temporary relief of an adequate character. We need not be deemed to approve of this inefficiency because we postulate it should be protected; the causes that have led to it in this country and in the colonies are various—partly political, and partly lack of incentive to overcome ingrained conservatism. But the operation or cessation of an industry is not exclusively a matter for its owners. The welfare of the workers is also at stake and so too in a broader degree is the country's trade and credit. Hence a Government's moral duty should be to induce efficiency in an industry rather than to see the industry penalized to extinction.

The Cuban Fiasco.

When on April 1st the stockholders controlling the Cuban single selling agency voted by a small majority to retain its services, it was reasonable to hope that the single seller would be allowed to continue undisturbed, at all events till the present crop had been disposed of, for then its influence on the course of the market could have been more accurately estimated.

Unfortunately strong American influences were being brought to bear, especially on the financial side. The Cubans were faced by the difficulty that if they continued through the single seller to hold sugar off the market they would need to finance the operation; but Cuba's finances have been tight for a long time, and the Americans were not disposed to oblige, especially as it would mean advancing money to be used to raise the price of sugar against the American market; it is said that the U.S. Federal Reserve Bank refused to allow members of the Havana Clearing House to lend any more financial support to the C.E.A. Be this as it may, the absence of any sufficient financial backing and the lack of a proper sense of co-operation amongst the members of the Cuban sugar industry made the outlook rather unpropitious, and a second vote was accordingly taken on April 14th, when a meeting representing about 23,500 shares out of a total of 25,000 voted by acclamation to terminate at once the Co-operative Export Agency as sole seller of Cuban sugar. An experiment, therefore, that seemed on the eve of success in securing a better market price for sugar has failed at the critical moment.

Admittedly the whole scheme was an attempt to corner the market and thereby to exact a better price than a free market promised to offer. Market manipulations if they result in abnormally high prices are to be abhorred as an infringement of fair trading conditions, and as holding the consumer to ransom. But the latter has no real right to expect his goods at a price that yields no profit to the producer. Cuba, as the largest single producer of sugar in the world, has made various attempts of late years to rectify this unsatisfactory position. She failed, as we know, to get the other leading producers to concert measures of restricted production so as to adjust the ratio of production to consumption. She failed also with her own voluntary restriction scheme, since it merely provided the opportunity for her rivals to make up the difference. There remained the final attempt to control the sales of her sugar through a single agency (a method of marketing that is worked successfully in Java) and this too has failed, it would appear, solely because the money was lacking wherewith to finance the scheme.

Notes and Comments.

Information to hand from Cuba suggests that the C.E.A. was actually in sight of success, and was knocked down by the financial interests as soon as this fact became apparent. The European and American refiners were in need to enter the market, as all the duty free sugars had been cleared by the middle of April ; the actual Cuban crop is turning out about 15 per cent. under estimates, and about 25 per cent. under that of last year. The Java crop estimate is also under that of last year and much of it unsold,[1] so that matters were coming to a point where the two countries could have come together and have secured a profitable price. This would have been assisted by the fact that the 1930 world crop will be probably 750,000 tons under that of 1929. Had, then, Cuba been strong enough financially, and her people been sufficiently educated to the advantages of combining their industrial forces (which they were not), her co-operative effort might have met with the success it deserved and the first step have been taken towards giving the world producer of sugar a more economic price for his output. As it is, to borrow a colloquial phrase, Cuba has been knocked into a cocked hat at the crucial moment, and the refiners have scored for the time being. Consequently, the end of the long lane is not yet in sight for the producer, and we fear it will mean that a number of weak elements in Cuba and elsewhere will drop out of operation rather than continue cultivating at a loss. This contretemps would of course contribute its share in restoring the balance between production and consumption, but looking at it from the point of view of the producer, one could prefer that the consumer should pay an economic price for his sugar here and now, rather than that production should be subject to such vicissitudes as to render the weaker elements bankrupt.

The Outlook.

It is difficult to venture on any estimate of the immediate coming trend of events. True, consumption is slowly overtaking production and the longer uneconomic prices prevail the sooner the balance will be struck or even passed, for while consumption goes forward, production will tend to go backward. But how long will the process take ? We give below two different views of the situation as expressed by market experts. Messrs. Czarnikow are chary of optimism, as they foresee a possible set-back to the progress of consumption. In a recent circular of theirs they gave their view of the situation as follows :—

"Sugar markets have for some time suffered from an over-abundance of supply, but the reduction in World crops this year gave promise of the ultimate attainment of a more even balance between Production and Consumption. Unfortunately, however, during the period in which our commodity has been regaining its equilibrium, other commodities have been gradually approaching a state of over-production from which a general marking down in values throughout the world has been witnessed. This has naturally led to a decline in prosperity in various countries which rely on outside markets for the sale of their produce, and has had a far-reaching effect on the spending power throughout the world. Although sugar is an essential article of food, and in many countries its direct consumption is not to any great extent affected by economic conditions, there are a number of consuming areas where the absorption of sugar is regulated by trade conditions, whilst the use of sugar in many articles which come within the category of so-called luxuries,

1 But it is said that the lack of sale is due to a studied policy on the part of the V.J.P. to hold the whole of the new output off the market for the time being and store it till better prices are forthcoming.

representing an important percentage of the world's consumption, is affected in times of financial stringency over a far wider area. In times of normal world prosperity the current year's supply of sugar would not in itself be sufficient to cause depression such as has been witnessed during the past few months, more especially in view of the extremely low level of prices at which sugar stands, which in the ordinary course of events would have stimulated consumption not only in the Western Hemisphere but also in the Far East, where the possibilities of expansion of consumption are more elastic. As to the future, it is impossible at present to form any decided views. Although it is difficult to find any justification for an important advance in the near future, it would, on the other hand, seem unreasonable to expect sugar to continue indefinitely at its present uneconomic level, and it remains to be seen whether the hoped-for revival of trade generally will bring about an improvement in the absorption of sugar, and more inclination amongst distributors to carry larger stocks."

On the other hand, Mr. GOLODETZ thinks that the shrinkage in stocks which has been going on since the beginning of the year in America and elsewhere will soon have to be made good, and that sundry decreases in consumption which have lately been recorded imply no more than an intensified cutting down of invisible supplies, which will ere long have to be renewed. He also records the impression that certain protected producing countries who make a point of exporting their excess production at the world's low price are not finding the business a financial success, and may decide for the time being to produce only within the limits of home consumption. Poland, Argentina and Brazil are instanced. As to the general situation, he writes: "The heavy slump in our commodity has been frequently spoken of recently as supplying a parallel to the slump in most other produce experienced in recent weeks. However, apart from the fact that the drop in sugar prices compared with pre-war values has gone deeper than with most other commodities, there is the distinction that the extent of actual over-production of sugar is much less important than that now on record for many other items of produce. Very little indeed stands between an over-production in sugar and signs of a slight deficiency. A few months' increased consumption can actually do the trick, providing that prospects for current and future production remain approximately as they are forecast now to be."

Cane Nomenclature Investigations.

At the Third Congress of the International Society of Sugar Cane Technologists, held during June 1929, at Soerabaia, Java, a Committee on Description and Identification of the Original Cane Varieties was appointed, under the chairmanship of Mr. W. W. G. MOIR. This Committee would like to secure all the information available on the subject in all countries where sugar cane is grown. Many people in the various sugar growing countries of the world travel to other cane growing countries and make very thorough and extensive investigations and reports on these other countries for their home industry. The Committee would greatly appreciate having a memorandum or report on the similarity or dissimilarity of nomenclature of the cane varieties noted. In this way the problem of straightening out mixed nomenclature will be greatly aided. Many of these notes are to be found scattered throughout old sugar publications, but a great deal of time is necessary to collect them and verify them. It is therefore hoped that all people who have

visited any other country and noted their cane varieties will kindly send a brief report to Mr. MOIR on their observations on cane nomenclature in this other country as compared with their own. Mr. MOIR's address is P.O. Box 3230, Honolulu, Hawaiian Islands.

Progress in India.

According to reports issued from the Sugar Bureau in Pusa, the efficiency of the Indian sugar industry is slowly increasing and both on the agricultural and manufacturing side results are in evidence. The number of factories making sugar direct from cane was 24 in 1928-29 as compared with 26 in 1927-28. The production of these amounted to 68,027 tons in 1928-29, as compared with 67,808 tons in the previous year. The average percentage recovery of sugar has shown steady increase during the past four years to 1927-28, being successively 7·81, 8·07, 8·49 and 8·62. The highest recovery achieved by a single factory in 1927-28 was about 11·5 per cent. and six other factories exceeded 9 per cent.

According to Mr. SAYER of the Sugar Bureau, this is satisfactory as far as it goes, but progress must continue. Factories need to keep constantly alive to improvements in their equipment and to any points or details that will reduce production costs, while the agricultural departments must increasingly test for canes with higher sucrose and heavier tonnage to enable factory improvements to pay for themselves on better results. In 1919 India's sugar industry was an object of mild solicitude, but has now reached the stage when it must move with the times, for if it cannot last the pace it will go under. The influx of Java sugar will only be stemmed by increased efficiency throughout the Indian industry. The time has now arrived for the latter to take stock of itself and of the foundation on which it is built. In many ways it is hampered by the financial arrangements of fifty years ago. It still clings to bazaar habits in its sugar marketing : it does not produce a standard grade, nor has it a standard name for its product; in short, it gives away too much through lack of unity. Collective organization, effective control, and, above all things, a united policy have become urgent matters, and the industry if it is to succeed must act and move as an all-India industry and not as a set of provincial units suffering from local whims and parochial prejudices.

On the agricultural side, the scheme of the Bihar Government for cane propaganda has continued to work well. Thanks to a premium offered, a considerable extension of the area under Co 214 has taken place, with a resulting marked increase in tonnage. Co 213 remains the best cane in those portions of the white sugar tract where the average rainfall is about 46 in. or less and no irrigation is possible. Co 205, given out for bad high lands, has done so well with the free growers that it has appeared on all classes of lands, but the mills are considering the limitation of its supply as it is extremely hard to crush and does not show to any marked extent the characteristics of a good factory cane. Moreover, it is too susceptible to mosaic. Co 281 has been exported to Cuba and Florida, and is highly spoken of there. Two trial imports of foreign seedlings have lately been effected. Four important Tucuman seedlings—T 472, T 407, T 393 and T 519—have reached Coimbatore for testing and if found promising will be utilized in crossing work ; while a supply of the Java POJ 2878, which has already been tested at Coimbatore, is now being tried out at Pusa.

Sugar Cane Work in Queensland.[1]

The general average production of sugar in Queensland appears to have now passed the half million mark. In the Report of 1927 it was stated to have reached a record of 485,745 tons, in the present Report for 1928 it is given as 520,620, and the estimate for 1929 is 515,000. This is in excess of the sugar needs of the Commonwealth by nearly 200,000, and there does not appear to be any tendency at present for the consumption to increase greatly. The general effect of this surplus, which has to be sold at considerable loss on the world's market, on the price paid to the industry and on the finances of Australia, was discussed last year.[2]

It is customary to divide the cane belt in Australia into northern and southern halves, Townsville, which is in about 19·3° S.lat., being the point of division. And a further division is made into northern, central and southern districts, roughly north of 20°, between 20° and 22°, and between 24° and 28° respectively. There are over 7000 cane farmers, with an average cultivation of 40 acres; and it is interesting to note that the acreage of the farms increases from south to north. Excluding a few farms of small area in the south, the average there is 29 acres, that in the central district 45, and in the northern district 53. On the whole, there does not appear to be any decrease in the size of the individual farms, for the average is given as 2 acres more than in the previous year. Two new and interesting diagrams are inserted in this report. The first of these shows clearly that the average tonnage of canes per acre has not increased materially during the last decade; and the second illustrates the march of the sugar industry towards the north during the same period. Incidentally, there appears to be a certain periodicity in the diagrams, especially in the last ten years, where similar three-year periods can often be distinguished. During the past year the work of the Bureau has been re-organized, and four divisions have been definitely instituted, with an officer responsible for each, i.e., soils and agriculture, pathology, entomology, and mill technology. These divisions appear to be very unequal in scope. Putting it simply and excluding pests and diseases, the first deals with all plantation matters and the last with the factory work,—the first with the multitude of cane farmers and the last with the 35 factories. A great deal of work has been already done on the insect pests, and during the last few years on the diseases of the cane; but the two other, greater, divisions have only just been started, and it would appear to be only a matter of time before the first, at any rate, will need sub-division.

The Division of Soils and Agriculture is in fact very comprehensive, and embraces "the agricultural experimental work of the Experiment Stations, cane breeding work, and chemical, physical and biological investigational work on soils and crops"; and the officers of this division appear to be at present mainly chemists. Pending the completion of the soils laboratory, a great deal of useful work has been started, in this division, on spreading out the experimental work of the Bureau over the whole cane tract, with the aid of the cane farmers. An appeal issued to them inviting their co-operation met with a very gratifying response, and during the year it was possible to select 46 farms, about equally scattered over the three main districts, carrying soils of major importance; and manurial experiments of a fundamental character have been laid down upon them. In general, a rather uniform type of trial has been aimed at, giving information regarding response to food constituents, single or in combination. This, as the head of the division, Dr. H. W. KERR,

[1] The Annual Report of the Bureau of Sugar Experiment Stations, Queensland, for the year ending 15th November, 1929. H. T. EASTERBY, Director.

[2] *I.S.J.*, 1929, 88.

points out, is a great advance on the former three Experiment Stations of Queensland, which only catered for certain climatic conditions and soils in their neighbourhood. Meantime, the experiments on these are being continued, but while interesting results have been obtained in the northern Station at Innisfail, those in the central district at Mackay and the southern at Bundaberg have been, as so often has been the case in the past, spoiled by drought or frost.

Variotal trials have also been started on farms in each district. In the northern section 11 trials were laid down with SJ 4, a local seedling, of great promise for the northern part of the Queensland cane belt; in the central district, four trials were made with POJ 2714 in the Mackay area; and in the southern, seven trials with canes for resistance to gumming, including some Co canes introduced recently, and which appear to be suited to these frost visited tracts.

For general agricultural work and the direction of the test plots on the farms, the field staff has been strengthened to four, two for the north district, and one each for the central and south. The ideal at present held in view is, however, to further increase this number to six, each one in charge of a section of the cane belt where he can best bring to the notice of the farmers such results as have been obtained in the experimental work in their tract; and also superintend the trial plots in his area, and act as liaison officer between the farmers and the department, for information and the collection of data.

Soil investigations.—As regards soil analyses, the policy of dealing with general samples sent in by individual farmers will be suspended; and in future only such will be analysed as have been collected by the field officers after a detailed inspection of the farm or tract. Thus the control plots of 40 of the manurial trials have been sampled during the year. Soil acidity and lime requirement have received special attention in North Queensland, where the farmers have shown great interest in the work, and a large number of tests have been made. The general principle guiding this analytical work seems to be gradually to collect sufficient data for a series of soil maps, which are to be regional rather than confined to individual farms. When results are obtained as to the probable corrective, from the manurial trials in any tract, they will be extended along these lines. As an example, the soil acidity and lime requirements of the soils in north Queensland are discussed. It is planned to make a series of analyses, say, one to ten acres over a limited area, and construct a map whereby individual analyses will be unnecessary, and the map may be used for any cane farmer in the area. Such an area has been selected over two square miles at Innisfail, and if this method turns out a success it can be applied to any other tract where the response in the trials is definite enough.

A complete study of the Queensland sugar soils and irrigation waters has been long contemplated, but held up for lack of a research officer: this will be immediately proceeded with now that one has been appointed. Further work is indicated on the effect of green manuring and trash, which has been almost entirely neglected, and also of by-products such as molasses and filter-press cake.

Cane breeding appears to be impossible in the Central and Southern districts, because the canes rarely flower and when they do are sterile, and further, the temperature is too low for the young seedlings. This reminds one of the conditions in India, which have relegated the raising of seedlings to Coimbatore in the south, in place of the great sugar tract in the north. It is proposed to try sowing the fuzz raised in the northern district and even to

test the possibility of transporting flats of seedlings, and to explore their further growth by artificial heat. Cane breeding will be considered in the report which follows.

Report of the work of the Northern Experiment Station at South Johnstone, by E. J. BARKE, Chemist in charge. It is the rainfall at this station which first attracts attention, because there are occasionally floods which cause widespread damage. For the past nine years the average has been 126·99 in. a year, the annual amounts varying from 77·50 to 202·52 in. The average distribution, month by month, during this period has been (September to August): 3·96, 2·55, 4·14, 10·51, 17·22, 22·66, 29·08, 15·02, 8·88, 6·44, 3·92, 2·61. During the year under review there were 145·00 in.; the rainy period was shifted back one month, so that that of November was 13·25 instead of the usual 4·14; and during the months January to March the astonishing quantity of 101·05 in. fell. It might be thought that this excessive rainfall would result in disastrous floods, but it is reported that "with high temperatures ideal growing conditions were experienced."

The experiments conducted on the South Johnstone Station were seven in number during the year, together with a variety trial plot. The experiments were of various ages, the principle being to plant canes and then ratoon them for two or three years, repeating the treatment for each crop excepting in liming. The yields in canes and sugar are given for each year's crop, and the average to date struck. Thus, where the current crop is second ratoons, the experiment is in its third year and the average is of three consecutive crops. The cane variety is the standard Badila and the land appears to be heavy acid alluvium. The plots are either single, or duplicated, or occasionally in triplicate. This method of growing plants and ratoons with repeated doses of the same fertilizers has some points of interest as we shall see.

The fertilizer trial (3rd ratoons, single plots) comprised single doses of N, K, P, the mixture of all these, and a no manure plot. The mixture gave, in plant canes, the lowest yield of all, even lower than the no manure plot; but thereafter it took first place and gave the highest average. The single fertilizer plots fell off markedly after the first ratoons, because of the absence of other plant food: the order in crop value was K, P, N, no manure.

Cultivation and manurial experiment, 650 lb. of mixed fertilizer and none, ordinary cultivation to 12 in. and sub-soiling added to 18 in. (1st ratoons, single plots). Both the no manure and fertilized plots gave better yields with sub-soiling, which is advantageous in this heavy alluvium.

Liming, one and two tons of burnt lime and none (plots in duplicate, first ratoon crop). The land was prepared with a green manuring crop which was dug in and rotted before the lime was spread and harrowed in. In the plant crop the yield was identical when one or two tons of lime were added, but a marked difference was seen in the ratoon crop. Lime was evidently needed, and it is suggested that the effect of the liming on the second ratoons may be of special interest. The conclusion in hazarded that at least one ton of lime will be needed in every "rotation" (five years) on this heavy acid land. In another experiment just started, coral lime was used. The response has been small, though significant.

Varietal trial (plant crop, randomized in triplicate). The varieties were Badila, SJ 3, SJ 4, SJ 16, SJ 28 (local South Johnstone seedlings). In tonnage of canes SJ 4 dominated, but was surpassed in commercial cane sugar by Badila: "The results from this crop bear out our previous conclusions, that SJ 4 is a very promising variety, but, due to its lower c.c.s. value as compared

with Badila, we would recommend it as a cane for the poorer lands of North Queensland."

Seedling Canes.—The raising of seedling canes commenced in 1921 at South Johnstone, and up to date some 40,000 have been raised, most of them by crossing tropical canes. A number of these seedlings yield a considerably higher amount of sugar per acre than the standard canes, but in general are disappointing in their resistance to disease. SJ 4 is one of the most promising, and at 12 months has yielded 9 tons of commercial sugar. During 1928 the following varieties were introduced from Java chiefly as breeding material: Kassoer, Glagah, POJ 2364, 2722, 2875, 2940, DI 52, SW 3, SW 499, and Black Cheribon. The 1929 programme was seriously curtailed because of the large number of parents not flowering or having no viable pollen. Two methods are adopted on the station, planting parents in adjacent rows, and cutting the male inflorescences and treating them with sulphurous acid solution. Where there is a chance of foreign pollen interfering, the arrows are bagged.

The Central Sugar Experiment Station, Mackay.—It is not proposed to refer to the experimental work here, which was largely spoilt by unfavourable weather, but simply to give some idea of the rainfall, as compared with that at South Johnstone. The average rainfall for 28 years has been 64·40 in.; but it is rather in its distribution than in its total quantity that it is at fault. The following are given as the average monthly falls during this period (September to August): 1·96, 1·82, 3·0, 8·37, 15·18, 9·64, 10·59, 5·59, 3·21, 2·57, 1·41, 1·06 = 64·40. In the year under report it is stated that no rain fell from 6th June until the 5th November.

In the Southern Experiment Station at Bundaberg, there is a good deal less rain than at Mackay, and the severity of the frosts is greater. During the 15 months forming the growing season, from August, 1928, to October, 1929, there were 33·69 in. of rain and "the past winter was the most severe since the institution of the station, and the successive sharp frosts did much damage to the cane, affecting both tonnage and quality." From last year's report it appears that the rainfall varies a great deal from year to year, the extremes given, since the founding of the station, being about 20 in. and 72 in.

Work in the Division of Pathology. A. F. Bell. This work is rapidly shaping itself, and the report is full of interesting matter. For obtaining disease-free planting material, surveys were carried out in 10 main districts. Such surveys, it is pointed out, are quite adequate for mosaic, Fiji disease and downy mildew; but they are not satisfactory for leaf scald and gumming, where canes, though showing no signs of disease during the growing period, may yet suffer heavily at maturity and during the dry period from September to November. With regard to these diseases, advice should only be given by a resident officer, who is acquainted with all the farms, and has had their canes continually under supervision throughout the year. On completion of the surveys, where desirable, lists will be prepared of farms suitable for the provision of seed. In addition circulars have been sent to the farmers at Beenleigh and Farleigh, with gumming and excessive mosaic, not to use their own seed. Such advice is at present not always followed, and a somewhat remarkable case is given of independence or wrong headedness: one farmer was found using seed with 5-10 per cent. mosaic infection instead of his own disease-free cane, but explained that "he believed in change of seed."

The following summary of these ten surveys will give some idea of the work of the division of Pathology, the surveys working down the cane belt from the middle north.

Giru (about 19° S. lat.) ; 71 farms examined, showing a reasonable state of affairs : 59 free from major diseases, and of the remaining 12, 7 had downy mildew and 5 had mosaic, the cane affected being B 208.

Lower Burdekin : free except downy mildew on B 208.

Proserpine : red rot generally distributed, especially on HQ 426 : downy mildew on two farms on B 208 : mosaic on the grassy banks of the river.

Farleigh (about 21°S.) : the outstanding disease is mosaic and resistant varieties are called for : gumming on 16 farms, but only in the streak stage.

Pleystowe : red rot and mosaic generally distributed but not severe : leaf scald in the Palmyrats section on HQ 426 which is susceptible to it, therefore no seed should be obtained from this section : mosaic bad in some sections as at Gargett.

Sarina : mosaic and red rot the only major diseases : the main problem is to prevent diseased seed from entering the district.

Bundaberg (25°S.) : mosaic all too common on the Burnett river farms : gumming continues to be of paramount importance, and is so widespread that new varieties are called for which are found to be resistant to it.

Maryborough : 196 farms inspected, Fiji disease found on 96 and mosaic on 113 : no definite improvement during the year, and apparently necessary to abandon D 1135 and 1900 Seedling.

Bauple : mosaic has decreased but there is still room for improvement : gumming was found on 12 farms, chiefly on D 1135 and EK 29. The presence of gumming in the district is serious, as the climatic conditions indicate that losses owing to the disease may be as serious as in Bundaberg.

Moreton (27°S.) : gumming is widespread in the district, but the more favourable climate and the greater proportion of the resistant variety Q 813 make the situation better than in Bundaberg. Seed selection within the district is now practically impossible, and resistant varieties are wanted to replace HQ 285, D 1135, and Badila.

The author then proceeds to discuss the major diseases in succession.

Gumming.—The main pathological problem of South Queensland, and slowly spreading to new localities. The damage was accentuated this year by the very dry spring (Bundaberg, August to October 0·77 : this dry period appears to have extended throughout the cane belt ; Mackay, as above, no rain from June 6th to November 5th, and South Johnstone 0·2 during September and October). Efforts are now being concentrated on the development of resistant varieties. This work is however complicated by the fact that the growth in the variety plots must be continued till October, because of the late appearance of the disease, and this time of year is too late for planting.

On taking over charge of the Division, BELL found that there was considerable uncertainty as to the relative resistance of varieties, because there were no data as to the length of time they had been in contact with the disease. Therefore a gumming resistance trial was planted with some new varieties added. Healthy seed was obtained of 18 varieties, but the plot was unfortunately ruined by heavy frosts in early July, when every cane was killed outright excepting those of Co 210, 213 and 227 and Uba, in which the percentage of death was low. In addition, these four varieties appeared to be unaffected by gumming. A "sweating" test was applied to some 40 dead canes of each variety. In all of them oozing of gum occurred, excepting the three Coimbatore canes, Uba and BH 10, 12. While very unsatisfactory, this test suggests that the Coimbatore seedlings show sufficient resistance to gumming to be placed in the variety trials for yield, and a number of such have been laid out.

A number of varieties growing in the nursery at Bingera were planted out in single plots of several rows and subjected to natural infection. The growing conditions were however comparatively favourable, and it was not to be expected that resistance in these plots would be maintained in the drier country. The trial was concluded on October 25th, when a count was made of the percentage of dead canes in each variety. Yellow Caledonia, H 227 and M 55 had no deaths : M 189, Q 1098 and POJ 2714 showed from 1·5 to 4·5 per cent. of dead canes, while in NG 24 the percentage was 32, in EK 28, 50 and in Q 694, 70. From these data the conclusion was drawn that Yellow Caledonia and H 227 should prove resistant to gumming in the forest soils of Bingera, and they now require to be tested as to yield. M 55 has many things against it : almost every leaf had streaks, in other parts of the district the yet living canes oozed profusely, and this cane was rejected years ago because of its low density.

In 1927 a single plot was planted of disease-free canes of eight SJ seedlings, POJ 213 and POJ 2714 at Windermere and subjected to natural infection. The plot was harvested in November, 1928, and the apparently sound canes were then planted on a larger scale, and the percentage of deaths ascertained in October, 1929. The results are given in a Table : for 1927 the percentage of dead canes, the percentage of oozing canes and that of apparently sound canes, for 1928 the percentage of deaths only. The resulting conclusion is that, with the possible exception of POJ 213, none of these varieties can be grown in any locality where gumming exists in South Queensland. Four further plots with 65 varieties have been laid down during the current season.

Fiji Disease.--Generally distributed in Maryborough and Beenleigh districts, but outbreaks have been discovered during the year on farms supplying Moreton and Bingera mills (all these places are in the extreme south of Queensland). Bell expresses his opinion that this disease is the chief menace in the main sugar areas in North Queensland, and thinks that on that account it may be necessary to adopt drastic measures to obtain absolute control in Maryborough and Beenleigh. For the study of relative varietal resistance, two trials of 25 varieties have been laid down in Maryborough, where secondary spread is rapid.

Mosaic disease.--A case believed to be mosaic was observed in Uba at Foulden, Mackay. The symptoms were typical on all but the youngest fully developed leaf, and diagnosis was difficult. Three small outbreaks of mosaic were detected in the Cairns district and the diseased plants were rogued out in each instance. This disease constitutes a major problem in parts of Proserpine, Farleigh, Pleystowe, Bauple, Maryborough and Burnett River, and in these areas control merits more attention than it receives. Attempts are being made to determine varietal resistance and mosaic losses, and to repeat the recently reported leaf puncture transmission of mosaic in Porto Rico.

Top rot and Spindle Top. The incidence of top rot was low in Lower Burdekin during the year, and little damage observed. But small plantings of POJ 2714 were badly diseased, suggesting that this variety may be quite susceptible to top rot. Top rot and spindle top (Sclerotium spp. ?) were much more in evidence in the far north than usual, believed to be due to the dry spring (September-October 0·2 in. at S. Johnstone), followed by intense and prolonged rainy season (133 in. November to March).

Field observations indicate that these two diseases are only of economic importance when early growth is retarded by unfavourable conditions : late

planting, late manuring, especially with nitrogenous manures, close planting and overcrowding with large number of small canes, shallow planting, bad seed heads, highly acid soils, lack of particular plant foods, inadequate cultivation, dry spring weather, and intense and prolonged rainy season. A detailed study of top rot, and possibly spindle top will be undertaken when DORMER returns to the Bureau.

Sour Rot.—This disease has been prevalent in Lower Burdekin during the year, especially on HQ 426 and to less extent on EK 28 : it could be found on practically every field of the former during July and August. BELL thus describes this disease : "The external symptoms are essentially similar to those of severe red rot, as in the case of red rot one or all of the sticks in a stool may be killed. Internally, a rot commences with a general yellowish discoloration of the storage tissue, usually restricted to the upper part of the stem. The tissue gradually turns brown in colour, and a sour rot with a faint disagreeable odour is produced. The rotting extends outwards to the rind of the cane and may or may not extend into the base of the stick. Usually the extreme base of the cane, at least, is apparently healthy ; later, the storage tissue becomes pithy and, finally, large longitudinal cavities are produced. The discoloured portions of the stick are very brittle, even in the early stages. The disease is provisionally termed sour rot ; it appears to me to have much in common with the 'Bacteriosis' of Java."

All the cane affected was in need of irrigation and appeared to have passed maturity. The variety mainly affected was HQ 426, generally considered to be a ten months' cane but here grown for fourteen.

Then follow a few notes on miscellaneous diseases seen, but at present of minor importance. Two new canes Co 281 and Co 290 received in March are growing in quarantine : preliminary tests in the West Indies indicate that the former is an early maturing cane. The BRANDES collection of New Guinea canes, growing in quarantine in Sydney, was inspected : 124 varieties germinated and of these about one sixth are non-noble canes. Approximately 100 of them were collected from regions visited before, so that a good many duplicates may be expected. Both mosaic and Fiji disease were re-introduced with this collection.

Isolation plots.—Atherton tableland nursery scheme : the initial planting of Badila has been extended, and some distribution will be possible next year. Tully is in need of healthy seed cane because of the large amount of leaf scald, and the impossibility of selection on most farms : much of the damage attributed to grubs has been found to be really caused by this disease, and a site is being sought for a nursery.

The necessary equipment for the Pathology laboratory has been purchased, and it is expected that the new building will be ready for occupation on or about the first day in 1930.

The Entomological Division is dealt with in three reports, one for each district, but there is not space to deal with them here : and furthermore this division has been more frequently commented on than that of pathology in the past. Lastly, the Division of Mill technology, which is only at present in the mill inspection stage, is not in the province of the writer of this review.

C. A. B.

DUTCH DUTIES ON SUGARED GOODS.—A recent Dutch law has abolished the surcharge of 20 per cent. on the sugar excise which was instituted on behalf of the Sinking Fund. As a result, the specific Customs import duties on goods containing sugar have been reduced, as from May 1st.

The Experiment Station of the Java Sugar Industry.

Some Account of the Organization and Work of a Model Institution.

By ARTHUR H. ROSENFELD,
General Secretary of the International Society of Sugar Cane Technologists.

It is with something of a feeling of awe and veneration that the sugar cane technologist enters the grounds of that historical and yet decidedly contemporaneous institution, the Experiment Station of the Java sugar industry, whose work has meant so much to the sugar industries of almost every cane-growing country on the globe; and the words "Proefstation Oost Java," painted in large black letters on the immaculate white front of the main building of the Station, evoke fleeting visions of the many countries in which the POJ canes bred here have served as crusaders against insidious diseases and unfavourable natural conditions.

The Station is located within the city limits of the quaint and mixed Dutch and Javanese city of Pasoeroean, and is magnificently housed and equipped, as well as supplied with extensive experimental field facilities for the exceptionally wide range of investigations which it has under way.

Pasoeroean is situated about sixty miles southwest of Soerabaia, the most important port of Java, located on the north-east corner of that fertile island. Driving from Soerabaia to Pasoeroean, over splendid asphalt roads, one passes though part of the extensive delta of Sidhoardjo, one of the best cane districts on the island, where magnificent fields of cane, almost exclusively POJ 2878 to-day, are seen growing to a height of 15 to 18 feet, and so well squared off and of such uniform growth that the tops would seem to have been gone over with hedge pruning shears were it not for the abundant flower heads so characteristic of this variety.

The experiment station to-day is in reality an amalgamation of the East Java Experiment Station at Pasoeroean and the Experiment Station for Sugar Cane in West Java, which was formerly located in Pekalongan; and its organization and administration really consist of three independent experiment stations, although these are to-day known as the *Departments* of Agriculture, Sugar Technology and Engineering. There is no individual director of the amalgamated station, but a Board of Directors consisting of the director of each of these departments. At present the Chairmanship of this Board is occupied by Professor E. C. VON PRITZELWITZ VAN DER HORST, the director of the Engineering Department. Dr. V. J. KONINGSBERGER is director of the Agricultural Department and Dr. E. P. HONIG of the Technological Department, while Mr. W. D. B. H. MULDER is Secretary of the Board. It was our privilege, upon arrival at Pasoeroean, to be met by all members of the Board and to be shown by them through the various departments of the Station.

ORGANIZATION AND ADMINISTRATION.

The Experiment Station is the property of the society "Experiment Station of the Java Sugar Industry," which is, in turn, a sub-organization of the "General Syndicate of Sugar Manufacturers in the Dutch East Indies" with headquarters in Soerabaia.

The Experiment Station Society was founded in 1907 and has its own governing board and financial resources, the president of the General Syndicate being *ex-officio* chairman of the Society. The resources of the Station — and this is one of the interesting and pertinent details of the Station organization—are obtained from a voluntary contribution of five guilders per gross

bouw (about one and three-quarter acres) actually devoted to cane, although in this gross acreage is included all land used for ditches, headlands and roadways. Figuring roughly at about $1·20 per acre, the Station receives in this way for its exclusive use, and with prohibition for any other use, a yearly revenue of between $550,000 and $600,000.

In order to stabilize the financial resources of the institution as much as possible, membership in the Society must be for periods of three years. In this way, the Experiment Station Board can always calculate its income fairly accurately for several years ahead and be able to lay out its work accordingly. Almost all of the 179 factories in Java are members of the Society.

As is common knowledge, in the years 1883-84 the Java sugar industry passed through some such crisis as that from which the Louisiana industry is just emerging. The Java slump was caused both by the drop in sugar prices at that time and the spread of the notorious Sereh Disease. As is so often the case, the proverbial ill wind produced some good, for, in the struggle for its very existence, the industry called for the aid of science in order that it might be better equipped for the severe competitive strife ahead of it. To be so equipped, a better and deeper insight into the various problems of cane cultivation and sugar manufacture in their broadest sense is essential, and the realization of this fact led to the founding of the experiment stations in Java.

It is probably not so well known that the first experiment station, which was established in 1885, was the Central Java Experiment Station at Semarang. The following year the West Java Station was established at Kagok, and only in 1887 was the famous East Java Experiment Station—POJ—at Pasoeroean founded. The establishment of these several stations resulted from the efforts of independent sugar planters' associations in their respective territories, as at that time the very rapid expansion of sugar cane planting and the enormous difficulties of communication made it almost impossible to study the distinct problems and guide the industry from one central point. In 1893, however, the Central Java Station was closed, and the West Java Station moved to Pekalongan in 1900.

In the early days of the Experiment Station, the main investigations were strictly agricultural ones, but gradually specialization in various directions began. The station at Pekalongan, up to the time of its fusion with the Pasoeroean station, always paid particular attention to manufacturing problems, while the Pasoeroean station was dedicated mostly to agricultural investigations. In 1905 a special Engineering Department was added to the Pekalongan station in West Java, as the need for more information on engineering problems began to make itself felt. In 1919 the Technological and Engineering Departments at Pekalongan were transferred to Semarang, and in 1924, when the stations were amalgamated, all departments were united at Pasoeroean.

When the Pasoeroean station was first established in 1887, it was housed in some abandoned gas works. It was only in 1904, or seventeen years after its establishment, that a special building was erected for the experiment station, that building having now become the centre of a constantly expanding complex of laboratory and office buildings.

Although, as mentioned above, the operations of the sugar experiment station may be divided into three very distinct branches of agriculture, technology and engineering, no definite lines of demarcation may be drawn between their duties and projects, this being especially true as regards the technological and engineering departments. As will readily be seen, many

problems pertaining to sugar manufacture must be studied simultaneously from these two major aspects.

Wherever the problem of joint projects presents itself, there is the closest co-operation between the respective departments, and smooth working in this way is, of course, facilitated since the centralization of all departments at Pasoeroean. The aim of all departments, individually and collectively is the search for optimum conditions during every step of cultivation and manufacturing, beginning with the preparation of the soil and ending only with the final shipment of the sugar.

Each director conducts his work independently, although the work of the Station is laid out by the three directors forming the Board. Each year the directors, after having consulted the advisers of the members (practically all of the large companies have their own technical advisers) can submit a working scheme to the chairman of the Society. This scheme is discussed at a meeting of the members, which is held each December preceding the year to which the scheme refers. This programme gives a complete survey of the investigations and the work planned in each department. At the end of each year, also, the Board of Directors reports on the work done during the year. The Chairman of the Board of Directors, assisted by the Secretary, is at the head of the general service which governs the administration, library, archives and the museum, which is now in process of formation.

PERSONNEL.

The permanent staff of the Experiment Station consists at present of about forty-five Europeans (Dutch), ten Chinese, and two hundred and fifty natives. In addition, fifteen Dutch local agents are employed in the Extension Service of the Agricultural Department.

The Experiment Station has at Pasoeroean thirty-four modern homes for the European staff, and eight of the fifteen houses occupied by the local agents also belong to the Station.

The entire staff is entitled to free local medical treatment, and the natives, in addition, receive their medicines gratis.

All of the Europeans receive a six months' leave in Europe after five years' service, on full salary and with transportation for themselves *and families* paid both ways. The European staff also has the privilege of a pension on a non-contributory basis.

One of the interesting features of the Experiment Station organization—and one of the principal reasons why the Experiment Station can carry out such extensive work on even the large amount of funds at its disposal—is the system of employing some two hundred and fifty natives in its work. As is well known, the Javanese native has an extremely limited earning capacity, due largely to the enormous population of the Island (Java is nearly the size of England or that of the State of Louisiana, and has a population at present of about 38,500,000) and an almost unlimited supply of the cheapest labour in the world upon which to draw.

The natives, however, are quick and make very careful technical workers when properly trained. The Experiment Station starts off with boys of from twelve to fourteen years of age, paying them at first about two guilders per month, or eighty cents in U.S. money, and increasing their remuneration, if their work is satisfactory, at the rate of one guilder, or forty cents, per month each year; hence, when one of these boys shows exceptional ability and renders good services for ten years, he will be drawing the magnificent salary of about

$5 per month, and carrying on work for which a European would have to be paid, at least, twenty times as much.

The boys the first year are put mainly to cleaning up the laboratories and offices and washing glassware, so that they may learn how to handle laboratory equipment. After a year or so, they may be put on crude balances, weighing out soil samples, etc. Later, they learn more careful weighing, how to take soil samples themselves, and are taught to make nitrogen, phosphoric acid, etc., analyses, free-hand drawing, mechanical drafting and the structure and operation of machinery.

Once the boys have become proficient in the laboratory, all determinations are made by them in duplicate, none of them knowing who is checking him. The European staff has only to compare the different determinations, and, where the results do not check, have the same or a different set of boys repeat the analyses. In this manner an enormous number of determinations can be made and complete soil surveys carried out from any angle, which would be impossible to carry on were a high-priced European staff necessary for their functioning.

These boys are also taught to run the large number of automatic electrically-driven calculating machines with which the field service figures out the results from their thousands of field experiments, comparing these with the factor of error in each case.

The writer had the privilege of seeing a large number of plates which are being made by native boys for a weed manual which the Experiment Station is to publish in connection with its weed survey of the Island. In this case the botanist of the Experiment Station, of course, oversees the work of these native artists and sees that botanical details are perfect. When this work appears, it will contain absolutely correct natural size drawings of the flower and foliage of every weed known in Java, and will have been prepared at a cost of only a fraction of that involved had European artists and botanists been employed in its confection.

The net result of this system is not only more extensive and more detailed investigations than would be possible under a normal cost system, but it relieves the heads of departments of almost all of the usually excessive detail work which is the lot of most heads of scientific departments and leaves them free for real constructive planning and genuine research work.

PUBLICATIONS.

The Experiment Station publishes a weekly periodical called the "Archive of the Sugar Industry in the East Indies," in which are given the working programme and results of the various projects as they are completed or brought to such a point that a report may be made. Another series is formed by what is known as the "Mededeelingen" or the "Communications of the Experiment Station," in which the statistics and the more detailed studies of the staff are reported. The *Archief* is the property of the General Syndicate of Sugar Manufacturers, which conducts its administration. The editorial staff of these publications is assisted by a committee of editors, consisting of experts in the agricultural, technological, engineering and, also, economic domains of the sugar industry.

In addition to the above publications, the Station publishes in mimeograph form the following periodicals which are sent free of charge to members and to such persons and institutions as are entitled to receive them : "Weather and Industry," in which are published data on rainfall, condition of the plantations and progress of field operations ; "Seed Journal," which affords to sellers of

seed the opportunity of offering their seed cane for sale. This industry, however, has been very much reduced by the almost universal adoption of the POJ 2878, the seed of which, when grown in the plains, seems to give just about as good results as when grown in the mountain gardens, something which was quite the reverse in the case of former standard canes, such as EK 28 and DI 52, practically all seed of which had to be grown in the mountain gardens and often by growers who dedicated all of their time and lands to this purpose.

During the grinding season, the Station also publishes a " Yield Report," in which data are published on sugar yields per acre for each factory, and the famous " Mutual Control Reports " which are a model in their field.

The Station likewise publishes a " Sunshine Record," in which a survey is given of the percentage of sunshine on a great number of estates in various districts of the Island. Finally, each of the three departments issues, whenever desirable, circulars and short communications dealing with current agricultural, technological and engineering problems.

THE GENERAL SERVICE.

Besides conducting the administration of the Station in general, the handling and filing of correspondence, etc., the general office has the task of compilation of periodical yield and rainfall records and the typing or mimeographing of all periodicals published by the Station. An idea of the extensiveness of the mimeograph service alone may be had from the fact that in 1928 more than 700,000 sheets were printed off.

The library is one of the outstanding features of the Station, and is easily one of the best in the Tropics, containing more than 20,000 volumes. There are over 400 periodicals, of which about 160 come from practically all of the cane growing countries in the regular course of exchange with the Java Station publications.

An interesting and efficient feature of the library administration is the publication monthly of a bulletin in which the newly received books and periodicals are listed, with the object of keeping the staff posted on recent acquisition.

The periodicals are distributed amongst the members of the staff by use of a novel circulating library service composed of about 30 boxes, the contents of which are renewed each week. Around 175 periodicals are thus in constant circulation amongst the staff. The library is catalogued according to the Dewey Decimal System, and books are lent not only to members of the staff but to anyone working in the sugar industry.

A further unusual and valuable feature of the library is its own book bindery, in which binding, cardboard and pasting work are carried on for the whole Experiment Station and its Extension Service. With the cheap and efficient labour of the native boys, the binding of the Station library is neatly and strongly done and at a cost not exceeding one-fourth to one-fifth that of doing similar work in the United States.

The filing of correspondence and other references is given special attention, advisory letters issued by the Station, and, in some cases, important letters received, being filed not under the name of the correspondent but under the subject discussed therein. The object of this system is to furnish to the members of the staff a complete survey of the experiments and recommendations of the Experiment Station as laid down in previous correspondence, an extremely useful feature when new advice is to be worked out. All letters are arranged chronologically in these files.

In the archives are also placed all reprints or separates and clippings containing information of value to the sugar industry. The clipping service is very extensive and detailed. In the archives one also finds catalogues, prospectuses, price lists, etc., of manufacturing and supply firms dealing in apparatus or chemicals used in the sugar industry.

As mentioned above, a museum is in course of organization to house a collection of preparations, samples of various sorts, control apparatus, machinery models, etc. It is designed to serve as a source of information to visitors and will be so arranged as to furnish a graphic picture of the development of the industry and the materials and appliances employed therein. A part of the front hall of the museum building is arranged as a lecture hall and is furnished with projecting apparatus adapted for both slides and motion pictures.

The Work of the Agricultural Department.

Space will not permit reviewing, even superficially, the extensive activities of the three main departments of the Station, but an attempt will be made to discuss briefly some of the salient features of the work of the Agricultural Department which is of most interest to the majority of us.

Rather antithetically it may appear, the work of the remarkably useful Extension Service will be considered first. As mentioned above, the Station maintains 15 local agents, or representatives, in the various sugar districts, each of whom superintends a group of 10 to 20 factories, in the midst of which he lives. The organization of this extension service was made necessary on account of the fact that the sugar factories and plantations are scattered over a distance of around 450 miles, this making it evidently very difficult to study local circumstances closely from one common centre. The local agents not only keep very well informed of the latest results of work carried on at the central station but have a thorough knowledge of the work of each of the factories and their plantations in their districts. They make a study of all factors affecting production, give daily advice and superintend the experimental fields of the estates, thus forming a connecting link between these and the main station.

In their duties come, also, the local study of the various soil types and the preparation of soil maps as a result of these studies.

The 15 sections allotted to the local agents are divided according to the boundaries of the old *residencies*, or districts, of the Island. In order that there may be as close a connexion as possible between the Agricultural Department and the local agents, two inspectors have general charge of the agents. These have their offices at the Experiment Station, where all the data collected by the local agents are studied and compared. It can readily be seen that, with such a well organized extension group of highly trained men, the extension service is in a position to offer consultations, give advice and collect and study data relating to every phase of cane culture from land preparation to harvesting. Besides all this, the extension service is of great value to the Agricultural Department in collecting information along any agricultural line. When any member of the personnel of the Agricultural Department desires information on some special topic, the extension service is in a position to supply the required data very quickly indeed. The local agents are all trained in the Agriculture Department at the Station before being sent to their posts. In most cases men appointed to these duties have their doctorates or are agriculturists with a university education.

As regards the research work proper of the Agricultural Department, this consists mainly of complete study of the cane plant from the standpoints of botany, taxonomy, cytology, internal and external morphology and genetics, the breeding of new varieties, soil study and the drafting of agrogeological estate maps, a survey of the weed fauna of sugar cane soils, as related to soil types, the planning of field experiments in general, the determination of fertilization optima and of the best time of planting as well as the best spacing of the canes, the diseases and pests of sugar cane and the gathering of statistical data on sunshine, rainfall and production of the distinct varieties in each region.

What is known as the Field Experiment Service has in its charge the study of all questions connected with sugar cane cultivation through field experiments or plot tests. The number of these field experiments is astounding and is constantly on the increase. In 1928 153 factories co-operated in field experiments and some 2400 distinct experiments were harvested. To date over 22,000 such experiments have been brought to a conclusion.

The experiments themselves are carried out by the factories under the advice of the Agricultural Department and remain under the supervision of the Department until they are harvested. The local agents control these experiments and send the results to the Experiment Station, where they are studied and checked up by the chief of the field experiment service for publication or future reference. These results are recorded on card indices and the results of the fertilization experiments are further entered on the maps of the different estates.

In 1928 special attention was paid to fertilization experiments in connexion with the newly adopted POJ 2878 variety, around 1200 of the field experiments being devoted to determining the optimum dose of sulphate of ammonia, which is almost exclusively used as a source of nitrogen, for the "wonder cane." In connexion with POJ 2878 the usefulness of the field experiment service is aptly illustrated by means of the enormous number of variety tests in which the newer varieties were compared with the old standard ones. The definite superiority of POJ 2878 was proved in such a short time that in the four years from 1925 to 1929 this variety has spread from 1 or 2 per cent. of the Javanese cane area until it now covers 93 per cent. and will probably cover 98 per cent. of the cane grown for the 1930 crop.

The Field Experiment Service considers that each experiment must be replicated at least ten times if reliable results are to be obtained, the checker-board test plot system being used in all experiments and each plot being harvested and milled separately. All averages are based on the theory of probability which, of course, makes a lot of calculating work essential. For this purpose the Field Experiment Service has at its disposal a special calculating office where all computations in connexion with the field experiments are made, as well as other statistical work. As mentioned before, this office is under native direction, and the work is done with modern calculating machines, many of which are electrically driven.

The section of Soil Survey and Research is splendidly housed in a series of rooms, eleven in number, partly surrounding an open-air laboratory where soil samples are unpacked, dried and prepared and where the water stills, agitators, etc., have been installed. One of the features of this section is a two-storey store-room for soil samples. Another is a drafting room for soil cartography, which is ideally planned for the work to be done, special attention having been paid to light arrangements. The main work of this section

consists of soil and fertilizer analyses, study of existing new methods of soil research, agro-geological cartology and biological soil research.

As a result of the extensive laboratory work and field experiments with soils and fertilizers, the Soil Survey and Research Department has arrived at the conclusion that only about 16 per cent. of the cane soils of Java need any phosphoric acid applications whatsoever, and, even on soil having a very limited phosphate content, application of this element does not always pay. Where the phosphate content approaches an established low value, field experiments are started to determine if artificial applications might give higher yields. Where such an experiment is started, a soil sample is always taken from the plot on which the experiment is laid out and forwarded to the Station for analysis in order to determine whether a correlation exists between the results of the field experiment and the phosphoric acid content of the soil extract. When it is considered that the Java sugar planters spend about $6,000,000 annually for sulphate of ammonia, it will be realized that general fertilizer analyses are very important.

A description of the magnificently worked out system of soil mapping and of the application of the Arrhenius Physiological method should be given in connexion with the work of the Soil Survey and Research Section, but the two physical limitations of time and space do not permit. The same applies to the excellent work of the entomological, cytological and cane-breeding sections, which is so extensive that a lengthy paper could well be devoted to each. Dr. BREMER's cytological researches at the Java Station are outstanding in this line of endeavour, and, while extremely technical in nature, are clearing up many involved points in cane-breeding.

And, last but by no means least, we can but mention the remarkable phytopathological experiments carried out at the Cheribon Station (which will undoubtedly shortly be merged with the Pasoeroean group) for many years by its eminent directress, Miss Dr. G. WILBRINK, who retired just after the recent meetings of the International Society of Sugar Cane Technologists, but whose investigations and publications on sugar cane diseases are known wherever the sugar cane flourishes. Miss WILBRINK has been succeeded by another eminent Dutch woman of science, Miss Dr. P. C. BOLLE, who has been assisting Miss WILBRINK for several years and who, the writer feels sure, will carry on the work of her distinguished predecessor with renewed credit for herself and to the continued benefit of the sugar industry of Java in particular and of the sugar growing countries of the world in general.

JAVA MOLASSES DATA.—In the 178 factories operating in Java 791,858 metric tons of molasses were produced in 1929.[1] Of this amount only 5·46 per cent. was sold in the hardened state; 13·65 was used for spirit manufacture in Java; and 72·12 per cent. was exported by the Pure Cane Molasses Co. Of the rest, 1·34 per cent. was burnt; 0·65 per cent. used for making caramel; and 2·49 per cent. was employed as fertilizer.

USE OF "SALOMETER."—The Committee on Clarification of the South African Sugar Association recommend that as an increase in the lime salts during clarification is to be deprecated the adoption of the soap test as carried out in beet factories be adopted as a general routine. They recommend also the use of the "Salometer" or other electrical apparatus for ash determinations by the conductivity method.[2] The Committee did not feel justified in adopting a certain apparatus for the determination of colloids, nor instruments advertised for automatically controlling the hydrogen-ion concentration of juices in the factory.

1 *Proefstation mededeelingen*, 1930.
2 Sold by the Sugar Manufacturers' Supply Co., Ltd., London.

Fibre Board Manufacturing Problems for Brazilian Sugar Factories.

By Dr. FREDERICO W. FREISE.

The unpleasant state of excess of production in the sugar industry has encouraged research to put to better use the resulting by-products, and among the ideas advanced the applicability of bagasse as a building board raw material has caught the attention of some Brazilian industrials.

As it is probable that such interest in the use of prepared bagasse some time or another condenses into enquiries about estimates, etc., reaching European manufacturers of machinery, it seems rather opportune to show the differences in economic bases as existent in Brazil compared with those in other sugar producing countries.

There are now about 64,000 planters of cane in this country, the area covered with cane being estimable as about 4350 sq. kms. (1680 sq. miles) and the amount of cane thereon at about 14 millions of tons. Sixty per cent. of these planters consume the crushed cane in their own homestead, e.g., as additional food for cattle—a very poor one at that—or as litter for stables, or even as repair material for roads and dams. Some 28 to 33 per cent. deliver their cane to the big sugar mills in their vicinity; the amount thus consumed may be estimated as about 9,800,000 tons. The balance between these amounts and the above stated 14 millions of tons drops out of sight, being disposed of in refuse incinerators or garbage heaps in the greater cities throughout the interior.

At the moment, 260 sugar factories are working in Brazil; to these go the above mentioned 9,800,000 tons of cane to be crushed. What becomes of the resulting bagasse ? Exactly 33 per cent. of all the factories supply their power and heat requirements by burning bagasse alone—only a few cords of wood being brought in for the first few days of the campaign before a suitable bagasse reserve has accumulated—but 67 per cent. of the factories have to buy heavy amounts of additional fuel—oil, fire-wood, coal—for the simple reason that their boiler house efficiency and their evaporation, crystallization, and their steam transportation equipment are far below technically normal or satisfactory conditions. In short, out of those 67 per cent., about one-third needs from 5 to 10 per cent. of additional fuel, one-half buys 10 to 25 per cent. and the remainder need as much as 30 to 40 per cent. of extra fuel; *there is no sugar factory which has a surplus of fibre to sell as building board raw material or to use it itself in an attached plant.*

In Brazil, firewood nowadays costs about £2. 10s. to £3 per ton at the boiler house, British or U.S. coal about £1. 15s. to £2. 10s., crude oil about £4. 10s.; one ton of medium coal is equivalent in B.T.U.'s to 2·2 to 2·5 tons of good hardwood. At the present time no sugar manufacturer can reasonably think of replacing more of his bagasse by firewood (as has been suggested by the very enthusiastic national daily press), in order to obtain from it a price that would compensate for the difference between bagasse and firewood. If all details of the sugar mill were arranged so that the best thermal efficiency was guaranteed, then possibly the problem would be discussable, as the returns from surplus fibre-board (made at an adjoining factory) plus alcohol would allow for the greater expense for firewood—or other efficient fuel; but from this state of affairs the average Brazilian sugar industry is still far away.

The only way to approach the building board manufacturing problem in Brazil for the time being would be the utilization of poor or worthless or

abandoned plantations or the different species of wild cane or fibrous stalks found everywhere. Here the problem of regular supply sufficient to feed a manufactury of economically good size has first to be solved, and far-reaching contracts with the owners of such cane have to be made, taking into account the numerous intrinsic considerations connected with delivery contracts in the interior of this country. (Where bagasse is sold, a price of 1s. to 1s. 2d. per ton is paid, but undoubtedly this price would no longer prevail when a bagasse-using plant of large daily capacity was in the market). A reasonable price for such raw material as mentioned cannot be stated, and very probably the industrialist would have to buy it on the spot, inducing the owner by métayage-contracts or crop-partnerships on the cleared land.

In some exceptional cases, a factory owner, possibly one of those who work great quantities of bought cane, or of those who hold big stretches of mortgaged land, might become convinced of the advisability to scrap his obsolete mill equipment and substitute for it a fibre-board and alcohol plant of modern efficiency; but these cases are located so far up-country that transportation difficulties and the distances from constructors preclude profit, at least so long as the present customs tax on such material as bagasse building board is not increased. It is to be expected that the first industrialist who builds a factory of this kind in Brazil will file a petition with the Minister of Finance to get his product protected by an increase in the tariff tax for imported material of similar quality, and this increase, undoubtedly granted as always has been the case for really new industries, will certainly allow the production of a national commodity at a profit. At present the customs tax permits one sq. ft. of board (U.S. product)—$\frac{7}{16}$ in. thick, 0·6 lb. per sq. ft. —to be laid on stock in Rio or Santos or S. Paulo at 2·4d., the selling price being somewhat about 4d. per sq. ft. in quantities from 1000 sq. ft. up.

The import tax on machinery is figured as 3d. per kg. gross weight; for transportation of heavy machinery on rail it is safe to figure £2. 6s. per ton and 100 kms.; trained labour has to be paid for at the rate of 6s. to 10s. a day, technical aid at twice that rate.

Near the sugar districts there is hardly any market for this commodity, the only likely purchasing centres being tho few great cities along the coast or some twenty or thirty more important places in the interior at or near good roads.

For Brazil there remains one important problem connected with fibre-board to be solved: will bagasse fibre-board be immune from attacks of "cupim," the xylophagus insect which attacks even the hardest specimens of virgin forest wood? Will it resist white ants? Actual experience of use has been too short to allow a positive opinion; at any rate it seems that special research work on this point is still missing in Brazil.

SUGAR REFINING IN SWEDEN.—The *Times Trade Supplement* remarks that the Swedish sugar industry is based largely on the indigenous cultivation of sugar beet, though the large refineries generally have to use a certain amount of foreign raw sugar in order to meet the country's requirements in refined. In normal years more than one million tons of beet are harvested, to supplement which only an insignificant quantity of imported raw sugar is necessary; but owing to dumping by countries that are habitual exporters of raw sugars, to the current low prices on the world markets, and also to inadequate tariff protection, beet cultivation is less remunerative than formerly and for the moment rather restricted. The Swedish public insists on a very high standard of quality of refined sugar (at least 99·95 per cent.). The factories are grouped under two undertakings, one of which accounts for 90 per cent. of Sweden's entire output.

Petree-Dorr Compound Clarification

As a Means of Removing Colloids from Cane Juices.

In recent years it has become very clear to the sugar manufacturer that colloidal impurities interfere with the evaporation of the juice and to an even greater extent with the crystallization of the raw sugar, thereby noticeably increasing the sucrose losses in the molasses. Enough are retained in the molasses film still adhering to the crystals to constitute an only slightly less troublesome problem in the refinery. There their presence manifests itself both in the filtering and the decolorizing stages. They adversely affect the ultimate yield of refined sugar.

Compound Clarification.

The observation that compound clarification, a modified form of double defecation employed in the Petree process, produced juices which were more easily worked, thereby relieving the load on filter-presses, evaporators and centrifugals, and from which a sugar of better refining qualities resulted, suggested that a more complete elimination of colloids was being obtained. This led the Carbohydrate Division of the United States Bureau of Chemistry and Soils to conduct an investigation of this subject in a Porto Rican sugar central. The results of this investigation are summarized in the accompanying table (Table IV of the investigation report) :

Colloid Elimination Per Cent. Total Colloids.

	Clarified Juice	
Sample—	Single defecation	Double defecation
No. 1	3·71	7·42
No. 2	25·66	35·98
No. 3	6·50	22·32
No. 4	11·57	20·20
Average	11·86	21·48
Purity	80·35	81·38

The investigators arrived at the following conclusion : " Table IV shows the average results from four complete experiments, all of which show the same tendency. An increased elimination of colloids as determined by the dye test was obtained with double defecation. These results were substantiated by ultra-filtration in one instance, in which the reversible and irreversible colloid contents of the double-defecated juice were found to be slightly lower than in the single-defecated juice.

" There was a greater rise in apparent purity in the double-defecated juice, and its general appearance was also improved. This improvement is attributable, in a measure at least, to colloid elimination by the acid defecation of the secondary juices where the quantity of mud was proportionately large.

" The primary muds introduced into the slightly limed secondary raw juice gave a large volume of flocculated material which served to adsorb and carry down a considerable quantity of colloids."

Operation of Process.

The modus operandi of compound clarification is as follows : The primary juice, together with the clarified " secondary " juice, is pumped through the primary juice heaters to the primary Dorr. From this primary clarifier about 95 per cent. of the mixed juice leaves as clean clear juice at a temperature of 209-212°F. The quantity of juice carried in the muds is therefore small.

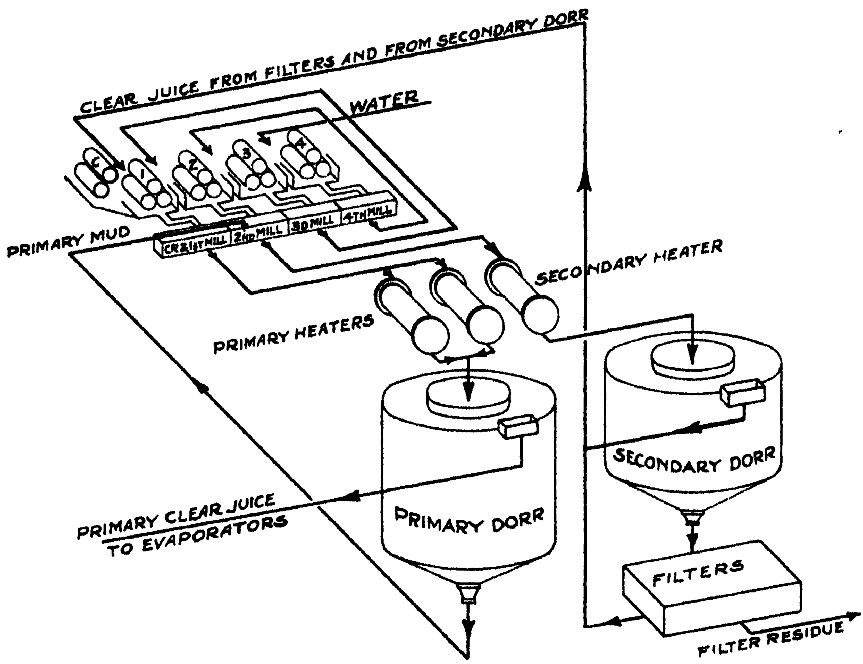
The secondary juice, which contains the bulk of the gummy and colloidal bodies, is limed separately, and after being mixed with the settlings from the primary clarifier is pumped through the secondary juice heater to the secon-

dary Dorr. This mixture of the primary mud with the secondary juice results in the formation of a special granular, dense, and rapidly filtering mud, and requires only half the filter-press capacity necessary for open defecation.

The colloids which are always present in greater amount in the juice expressed from the macerated bagasse than in the virgin cane juice, are by this means enveloped in the flocs resulting from the treatment of the virgin juice and are thus eliminated to a larger extent than would otherwise be possible.

RESULTS.

The high filtrability of the mud insures at all times a firm cake which readily separates from the cloths, thereby lengthening the life of the latter. Plate-and-frame replacements are reduced to a minimum, as it is no longer necessary to resort to high pressures. The press work is speeded up and the volume of mud in process is reduced, with a corresponding reduction of loss of



P-D COMPOUND CLARIFICATION applied to 14-ROLL MILL

heat through radiation, undetermined loss of sucrose, poorly filled presses, and breaking cloths. The elimination of the usually dark filter-press juice improves the quality of sugar produced (especially when sulphited sugar for direct consumption is made).

Without exception, every factory using compound clarification reports an increased boiling-house efficiency number. Reduced sucrose losses at the filter-press station account in part for this increase, as does the lower viscosity of the molasses, due to more complete elimination from the juice of gums, waxes, and other colloid bodies. Cuban users of this process state that owing to the juices from the Dorr being cleaner and hotter, they can handle from 6 to 9 per cent. more juice in their evaporators and vacuum pans than they had been able to handle previously when using open defecators.

Java Technical Notes.

Activities of the Experiment Station. *Archief voor de Suikerindustrie in Nederlandisch-Indië*, 1930, **38**, I, No. 3, 40-49.

Each year the Experiment Station formulates its "work-plan," and for 1930 under the heading of the Technical Division one finds the following: calibration and testing of manometers, indicators, thermometers, pyrometers, and water meters, sent in for examination; repairing instruments that cannot be attended to by the factories; compiling reports on questions concerning installations; fortnightly publication of milling results and fuel control lists; investigations concerning installations, aids, methods, etc., in factories and at the Experiment Station; patent questions; collaboration with the Editors of the *Archief*, and compilation of various technical reviews for periodicals. Under the heading of the Chemical Division are the following; analysis of samples of products, by-products and aids sent in by factories; investigation of methods of analysis used in the sugar industry; calibration and testing of flasks, weights, balances, polarimeters, etc.; publication of reports on questions concerning manufacture; investigation of difficulties and irregularities arising in manufacture; fortnightly editing of factory results; patent questions; publication of the yearly reports; and collaboration in the editing of the *Archief*. In an appendix is set forth the advantages of abandoning the Mohr unit of volume at 17·5°C. now in use in Java factory laboratories in favour of the International unit in general use elsewhere, these being summarized as follows: the possibility of comparison with the results obtained in other countries; the use of the same system as the Experiment Station; and simpler temperature corrections in determining the Brix. A new table would have to be introduced giving the relationship between Brix and specific gravity according to the new method. This table has been calculated by the Experiment Station for true c.c. and a normal temperature of 27·5°C. from Plato's data.[1] This means that tables in use since before 1865 are abandoned, and that the so-called Moll's tables must be altered. In fact the new (fourth) edition of these tables about to be published will give them on the basis of true c.c. and a normal temperature of 27·5°C. Another appendix concerns the calculation of the recoverable sugar in juices, etc., which for factory control should be calculated according to the formula:—

$$S = \frac{r}{100 - r}\,(B - S),$$

in which r is the true purity of the factory molasses, and B and S the Brix and polarization respectively.

Factory Control Returns for 1929. **C. Sijlmans.** *Mededeelingen* 1930; *Proefstation voor de Java-Suikerindustrie*, 1-71.

These very numerous data are presented in four tables. No. 1 gives figures for the five crops, 1925 to 1929, for the unknown lost pol. per cent. pol. of raw juice; the sucrose Brix purity of the molasses; and lastly the "comparison figure" of the Proefstation, this being compiled according to the two figures just mentioned. Table 2 gives the "Technical and Effective Results" for all factories for 1929, which are arranged in order according to the comparison figure of the Proefstation. Among the technical figures returned are: pol. filter-press cake per cent. non-sugar of raw juice; sucrose in molasses per cent. non-sugar raw juice; sucrose not obtained as crystal excluding unknown losses per cent. non-sugar of raw juice; ditto, but per 100 pol. raw juice at 85°; unknown lost pol. per cent. pol. raw juice;

[1] Published by the Physikalisch Technische Reichsanstalt, 1900.

comparison figure of the P.S.; non-sugar in molasses per cent. non-sugar in raw juice; ditto, per cent. non-sugar in clarified juice. "Effective results" comprise the lost polarization per cent. pol. of cane: (*a*) in manufacture, (*b*) in the bagasse, and (*c*) total. Table 3 gives voluminous data for: cane ground; pol. introduced in raw juice, per cent. cane; polarization obtained in products and by-products, also unknown; molasses obtained per cent. calculated; recoverable crystal per 100 primary juice; obtained crystal per cent. cane; Winter rendement (crystal). Besides there are complete figures for raw juice; filter-press cake; clarified juice and syrup, massecuites and molasses; results are also given for *pH* values, acidities, and various analyses of the products. Table 4 gives the dimensions of the principal stations of the defecation, sulphitation and carbonatation factories.

In his comments on the figures, the author points out a sucrose/Brix purity was reached by 11 factories, Delanggoe (carbonatation) the lowest being 29·5, and Blimbing (defecation) being next with 29·6; while the lowest sulphitation factory was Ngadiredjo with 31·1. On the other hand the factory having the highest purity molasses was Assombagoes (defecation), viz., 40·5; and there were eight others higher than 38·0. Factories having a higher "unknown crystal loss per 100 pol. raw juice" than 4 numbered 14, one of these being Bandjaratma (sulphitation), which reached 6·2. On analysing the figures for the technical and effective results, it is seen that these were less favourable in 1929; and that the rise in the losses noticed in 1928 has been continued. This for the greater part is the result of higher molasses losses and of higher unknown losses. Why the molasses should be higher in purity during the past two years is difficult to say, but it may be due partly to the greater rate of grinding and to the varying composition of the non-sugars, which during 1928 and 1929 have shown in general a lower amount of reducing sugars per cent. non-sugars, though a higher ash content. As to the higher unknown losses, entrainment in the evaporators and pans as the result of the increased rate of working may have had to do with this.

FINAL FIGURES FOR THE 1929 MILLING CONTROL. *Mededeelingen*, 1930. *Proefstation voor de Java-Suikerindustrie*,

During 1929 altogether 179 factories took part in the "mutual control" returns, and the results calculated by the P.S. are set forth in the numerous tables which comprise this report. In the first series of tables, factories are divided up into groups according to their milling equipment; and in each of the groups the factories are arranged according to their "lost juice per 100 of fibre." A resumé of these tables is given in the following figures, showing the averages for each of the groups:—

1929 CAMPAIGN.

Installation	No. of equipments	Lost juice	Extraction	Maceration per 100 of fibre	Metric tons cane per day excp. stoppages basis of 30 × 60 in. rolls.
Only 3 mills	10	52	92·0	129	725
Crusher and 3 mills	7	49	92·9	132	851
Only 4 mills	29	42	94·2	140	760
Crusher and 4 mills	39	39	94·8	147	975
Only 5 mills	13	33	95·6	145	775
Crusher and 5 mills	23	33	95·5	139	1052
Total	189	39	94·6	143	919

In regard to this lost juice figure, it is interesting to note that at Kedawoeng s.f. which has a milling installation of four mills and Nobel hot maceration carriers between the 2nd and the 3rd and between the 3rd and the 4th, a lost juice factor as low as 21 was calculated, the extraction being 96·6. This result was distinctly better than that obtained at Koedjonmanis with its six mills, viz., 39 ; or at Tasikmadoe with a crusher and six mills, viz., 33. On the other hand, Toelangen with a shredder and five mills and one Nobel maceration carrier between the 4th and 5th mills showed a loss factor of 19. In other tables, various other data are returned including the following giving the average for all the factories : Primary juice, Brix, 19·7, Q.P., 86·1 ; last mill juice, pol. 3·3, Q.P., 77·1 ; pol. per 100 bagasse last mill, 3·0; water, ditto, 44·8 ; mixing factor, 53·0 ; imbibition water (maceration), per 100 fibre, 143 ; undiluted juice in last bagasse per 100 fibre, 666 ; Brix-free cane water per 100 bagasse, 22 ; pol. per 100 cane, 13·9 ; fibre, same basis, 12·7 ; undiluted raw juice per 100 of cane, 79·4 ; extraction, 94·6 ; and juice in bagasse 1 per cane fibre, 223. Other data recorded include : Milling equipment and maceration method for each factory ; weight of fibre (kg. per litre) passing through front and rear openings ; hydraulic pressure on top rollers ; measurements of the rollers ; mill settings ; etc.

PARTICULARS OF METHODS OF WORKING IN DEFECATION, SULPHITATION AND CARBONATATION FACTORIES IN JAVA. **C. Sijlmans.** *Mededeelingen,* 1930. *Proefstation voor de Java-Suikerindustrie.*

In an appendix to the Factory Control Returns for 1929 are given brief particulars of any special methods that were in operation during the year mentioned, some selected here and there being as follows : *Defecation.*—Hot liming ; continuous liming at boiling point ; unsweetened press-cake macerated with water[1]; addition of phosphoric acid to the raw juice to assist subsiding ; *B*-massecuites boiled on a *pied-de-cuite* of molasses sugar pugged with *A*-syrup ; molasses sugar dissolved on the clarified juice sieve. *Sulphitation.*—Addition of lime and phosphoric acid to badly filtering muddy juice ; part of the *C*-sugar and the molasses sugar dissolved in clarified juice and returned to the sulphited syrup ; separate clarification of the secondary mill juice ; addition of " Hyflo " in the case of badly filtering muddy juice, using about 0·5 kg. per subsiding tank of 60 hl. (1320 gall.); syrup filtration over *dooq* followed by sulphitation ; molasses sugar pugged with syrup and the after-dried dissolved in the clarified juice ; *C*-sugar dissolved in clarified juice to 65° Brix, strained, and mixed with the filtered, unsulphured syrup, the after-dried molasses sugar being pugged with syrup and used so far as possible for the *C*-massecuite ; cold raw juice pre-limed with 2 litres of milk-of-lime at 15 Bé. per 1000 litres, followed by ordinary hot sulphitation ; molasses sugar dissolved in clarified juice, strained, and returned to the unsulphured syrup ; liming according to VAN DER JAGT,[2] and sulphitation at 80°C., the result being more regular and more rapid, with good settling, low lime content, and cleaner evaporators ; clarified juice and syrup filtration with " Hyflo," (0·5 kg. per 100 Brix) the syrup being filtered without dilution using a pre-coat ; syrup filtration according to BACH ; liming cold raw juice to about neutral reaction, using 4 litres as 15°Bé. per 1000 litres, heating to 75°C. and afterwards sulphiting in the ordinary way. *Carbonatation.*—Single carbonatation ; remelted molasses sugar is submitted to a treatment with lime, phosphoric acid and " Super-Cel," and afterwards filtered through " Carboraffin,"[3] the liquor being used in order to

1 *I.S.J.*, 1930, 139. 2 *Archief*, 1928, 1, 230. 3 *I.S.J.*, 1929, 374, 430.

build up *pied-de-cuite*; molasses sugar dissolved in clarified juice and returned to the unsulphured syrup; juice limed cold to a slightly acid reaction, heated to 65-70°C., and afterwards carbonatated as usual, the result being better filtration.

LOSS OF SUGAR IN MILLING, DUE TO MICRO-ORGANISMS. **A. P. Neeb.** *Archief*, 1930, **38**, No. 5, 92-109.

One of the outstanding problems in cane sugar manufacture is the determination of the extent of the loss of sugar during milling, and the discovery of some means of restricting such loss so far as possible. An attempt was made with the assistance of the E.S. to study this question. Preliminary tests showed the interior of apparently sound cane to contain micro-organisms, about twenty different ones being isolated, and brought into pure culture. Counts were made of the number of micro-organisms (excluding moulds) per c.c. present in the different juices, and figures of the following order were obtained: first mill juice, 1,500,000; fourth mill juice before washing down, 5,000,000; and ditto, after washing down, 1,875,000. *pH* determinations were investigated as a possible means of indicating the degree of infection, but it was observed that all juices from first to last showed practically the same value, viz., 5·2 to 5·4 *pH* before and after washing down the mills. On the other hand, it was found that titrations of the acidity (CaO per 100 of Brix) of mill juices and also maceration juices did afford some guide to the activity of micro-organisms. Another observation made to which emphasis is given concerned the fact that two milling tandems both consisting of a crusher and four mills gave remarkably different results so far as the fall of purity from the first to fourth mill juice was concerned, thus:

	Q.P. 1st mill	Q.P. 4th mill	Difference	Brix 4th mill	Pol. of Bagasse
Brangkal sugar factory ..	86·6 ..	72·7 ..	13·9 ..	5·45 ..	2·70
Gempolkrep sugar factory..	86·7 ..	91·1 ..	5·7 ..	6·48 ..	3·38

And this in spite of the fact that at Brangkal extra care had been taken always in the cleaning of the milling installation. It was not possible to explain the difference in the fall of purity of the two sets of juices, all the conditions in both being apparently similar. Then the author goes on to point out that a means of obtaining some kind of indication of the loss of sugar caused by the activity of micro-organisms would be provided in a factory having two tandems. One would be extra well cleaned by being continuously steamed during the whole of the test, lasting perhaps a few days. Moreover to this same mill one would apply hot maceration, and preferably a disinfectant as formalin at the first mill. Nothing would be done in the way of cleaning the other tandem. Both tandems having ground the same cane, it would be easy at the end of the test to calculate the sugar content of the cane ground by the two tandems, a higher figure being shown in the case of the clean installation. An indication of the extent of the loss under such relative conditions would thus be afforded by the two figures.

CHARRING OF SUGAR IN CENTRIFUGALS BY SUPERHEATED STEAM. **W. C. Bedding.** *Archief*, 1930, **38**, I, No. 10, 256.

In the "Annual Report of the Experiment Station for the Year 1927" a case of sugar charring in the white sugar centrifugals of a carbonatation factory was published,[1] but the cause of this was not directly sought in the high temperature of the superheated steam used for covering the sugar. It

[1] *I.S.J.*, 1929, 222.

was explained that a small amount of oil had become decomposed in the live steam line at the high temperature to which it had been raised, which carbon mixed with some reduced particles of iron acted on the sugar as an oxygen carrier, thus decomposing it. Another case lately occurred in one of the factories of the Klattensche Cultuurmaatschappij, but to a less extent, causing only the grey colouring of the sugar ; but some particulars of the case are here given regarding it, as it offers an insight into the cause of the phenomenon already noted. Under the microscope the sugar showed itself to be permeated with fine particles of carbon. At the time this greying of the sugar was observed, it was also noticed that the boiler-water contained sugar and priming had taken place, so that this water had passed over into the super-heater. In this case, therefore, the explanation is simple : Sugar from the boiler-water had become carbonized in the superheater, forming extremely fine carbon particles, which had been blown over into the centrifugals. Still, the possibility exists that boiler-water having a high oil content may exhibit this phenomenon on priming of the boilers as well as water containing sugar. Oil easily passes over with superheated steam, though a carbonization of lubricating oil occurs in general at a higher temperature than with sugar.

SUGAR CONTENT OF CARBONATATION PRESS CAKE. **J. W. Le Comte.** *Archief*, 1929, **37**, II, No. 53, 1107-1115.

The present meth'd of sampling press-cake in carbonatation factories may lead to marked errors. Results are obtained which may be too high or too low, according to the direction which the probe has taken, whether it has penetrated the portion of the cake lying against the water-frame, or that against the juice-frame. Many factories in Java now dump the press-cake into tanks or lorries, mix it up with water, and run it away to river or pond. According to the method of working here advised, the coolie-in-charge samples the thin paste from time to time, and sends the samples up to the laboratory. There the density is taken by a Bé. spindle just as in the case of milk-of-lime, the dry substance corresponding to this density being obtained from a table ; whilst the sucrose content is calculated from the polarization of the filtered liquid.

1929 FUEL CONTROL RETURNS. *Mededeelingen*, 1930. *Proefstation voor de Java-suikerindustrie.*

Data for each of the 173 factories taking part in this control are recorded, and following are some of the average figures given, for defecation and sulphitation factories respectively, these two figures expressing calories per kg. of cane : consumed, 623, 687 ; available in the bagasse, 604, 613 ; in the supplementary fuel required, 31, 77 ; in any bagasse left over, 12, 3 ; in cane trash, 26, 78 ; in the dry steam, 335, 374. In another series of tables are recorded various other data, the averages for which for each factory work out as follows: cane ground, metric tons, 138,795 ; calories per kg. of wet bagasse, 2485 ; calories per kg. dry bagasse, 4528 ; bagasse per 100 of cane, 24·7 ; raw juice per 100 of cane, 93·2 ; calories used per kg. cane, 661 ; steam per 100 of cane, 64 ; kg. steam per sq. m. evaporating surface per stoking hour, 17 ; Brix raw juice, 16·8 ; Brix clarified juice, 17·2 ; and Brix evaporator syrup, 61·2. There are also tabulated the quantity of supplementary fuel in wood, cane trash, baled bagasse left over or from other factories, and oil, molasses, etc., also the fuel stoked to locos, and the water used for washing and for sweetening off, which figures are not averaged. Water in bagasse averaged 44·8 with extremes of 52·3 and 37·1, the latter figure being for Djombang, where there are two Nobel hot maceration carriers working. Steam consumption per 100

of cane, the number of calories in dry steam per kg. of cane ; and the steam production per sq. m. of evaporating surface per hour were all calculated with the weight of the boiler water as the principal figure, and the wide variations in the returns under these headings are probably to be ascribed to faulty action of the water meters. On the average, the supplementary fuel necessary amounted to 8 per 100 bagasse, so that the calorific value of the total fuel stoked would be this amount more than that of the total bagasse obtained, Regarding the composition of the extra fuel required for all the factories the year under review, this was : wood, 9·0 ; trash, 72·9 ; baled bagasse, 16·5 ; molasses, 1·5 ; etc., 0·1 per cent.

The Sugar Machinery Market in Mauritius.[1]

Mauritius, with its 376,485 inhabitants, is virtually dependent for its economic existence on its sugar crop, and the bulk of private and public revenue is directly or indirectly ascribed to the industry. It is distinctly a one-crop country, despite the fact that some Mauritius hemp (also fibre) is raised and exported, as by value sugar accounts for about 98 per cent. of the annual exports.

Although the centralization of milling has been practised to some extent, the present organization of the industry is still considerably decentralized. There were, in 1927, 193 sugar estates in the island. The cane acreage of those with mills totalled 55,645 and of those not so equipped 40,286. All told, 140 mills, possessing some 35 crushers are at work. There are about 32 derricks in operation—most of them of American origin. Still, almost every year some of the small and unprofitable units are closed down, and at the end of 1928 there were 43 usines serving the industry as compared with 57 at the end of 1916.

The usines are equipped with a variety of the basic elements of modern sugar production. Every one is equipped with electric light, and there are 76 dynamos in use, with 30 suction gas engines, principally of German origin, also in operation. Every factory has installed centrifugals of the British type, the total number in operation being 777 in 1928. Quadruple evaporators easily lead in popularity, which, together with 198 vacuum pans, 809 crystallizers, and other equipment, meet the average demands. Bag filling and sewing machinery is installed in a number of factories, but in some instances hand sewing is carried on by low-paid Indian labour.

The principal equipment in operation in 1928 in the factories is enumerated below and will afford some idea of the extent of operation of the industry.

Number of mills	140	Number of vacuum pans	198
Number of usines	43	Barometric Condensers	35
Derricks	32	Evaporation plant	† 43
Crushers	* 35	Economizers	* 47
Boilers	205	Fascines (Water Coolers)	22
Messchaert Rolls	* 195	Defecators	65
Juice-heaters	103	Decanters	288
Centrifugals	777	Filter presses	52
Crystallizers	809		

In connexion with the sale of machinery to the various estates, there is perhaps no more important factor than that of proper representation. Owing

1 Extracted from a Consular communication in *Commerce Reports* (Washington).
* For 1926. † Total surface 342,000 sq. ft.

to the long establishment of most estates and their descent in the family line, there is a distinct leaning toward old engineering firms with which dealings have been maintained for years. In addition, there have sprung up machinery houses which are offshoots of estates and are owned and operated by relatives, and to these the estates concerned confine their business. On the whole, estate and factory owners and managers are conservative buyers and do not respond readily to innovations and new types of machinery, it being diffcult to influence their purchases of replacement units that involve any radical changes over those with which they are already familiar. Several of the better-known manufacturers of sugar machinery have successfully augmented their distributors' activities by sending out competent factory representatives periodically, but, when such a procedure is followed it should be carefully determined as far as possible that the factory man will be favourably received by the average prospect in Mauritius. Branches of overseas firms, engineering houses, and general merchants afford the chief channels of distribution, all of which maintains stocks of parts and furnish the service absolutely essential to the successful maintenance of sales.

Industrial machinery used in the sugar industry is predominately of British origin, with Scotch manufacturers controlling a fair share of the market. An analysis of Mauritian imports of the principal items of sugar machinery for the past three years shows that, according to value, the United Kingdom's shipments constitute 72 per cent. of the total imports. It should be remembered, however, that there is the possibility that both American and European machinery may to some extent be represented in the United Kingdom's total, through indirect shipment, or agencies located in England and Scotland. Nevertheless, the high percentage of trade indicates the dominating position held by the British producers of sugar machinery. The United States during the same period furnished only 7 per cent. by value of the total machinery imports, and its participation in the general trade by direct shipments was confined chiefly to derricks, centrifugals and "other sugar-making machinery." France did a fair business in juice-heaters, filter-presses, cane cutters, and "other machinery," but did not control the share of the sales one might expect in view of the fact that many of the factories and estates are owned by French people. German boilers have become increasingly popular in late years; boilers, dynamos, and "other machinery" constitute a fair share of the sugar-machinery trade between Germany and Mauritius.

In the face of present economic conditions in the island and the low ebb of sugar-estate earnings resulting from low prices there is little to encourage the manufacturer of sugar factory equipment and machinery. There is no doubt that the factories of Mauritius could, in many instances, advantageously undergo a fair amount of re-machining, but from all appearances the progress along such lines is likely to continue slowly. A substantial amount of the overhauling remains undone at present because ready capital is lacking. On the whole, conditions are not regarded as particularly favourable for the increased sales of machinery and supplies, and extended credit is the basis of virtually all sales that are being made.

South African Production.—According to the Standard Bank of South Africa, all raw and mill white producing factories in South Africa had closed down by the end of March, and the final production figures for 1929-30 are given as just under 299,000 tons, of which about 126,000 tons have been exported. For the 11 months ended November imports of sugar from overseas totalled about 19,000 tons, valued at £229,000, compared with about 14,000 tons valued at £173,000 during the corresponding period of 1928.

Beet Agricultural Notes.

UTILIZING FROZEN BEETS.

The Great Western Sugar Company, Colo., U.S.A. made an extended inquiry into the question of utilizing beets left frozen in the ground on completion of the last harvest and campaign. Only two courses remained: (1) Feeding the beets to live stock; (2) Ploughing the beets under. Experts were asked for their opinions. On feeding, the consensus was that the frozen beets while still in the ground could safely be pastured to all kinds of live stock which also were given hay or other roughage. For sheep and hogs, the beets can be pastured while still in the ground. This stock eats the tops and crowns. Under favourable conditions they also consume from three to four inches of the roots. For cattle, the favoured method is to plough out only sufficient of the frozen beets for the cattle to clean up in a few hours each day. Repeated alternate freezing and thawing of the beets causes decomposition and deterioration which makes them worthless as factory raw material. But this does not cause any poisonous products for feeding purposes, if the beets are fed carefully. The live stock should be pastured on the roots before they have time to spoil badly. For cattle feeding purposes, where it is planned to plough out the beets as needed by the stock, this should be done if possible before any danger of complete decay of the roots.

If the roots are not fed and the farmer is left with the necessity of ploughing the crop under, the beets should be cut up to the utmost degree feasible. Every reasonable effort should be made to leave as little of the beets in the ground as possible; and, next to that, where whole or substantial portions of the roots would have to be ploughed under, thoroughly to double disc and cut up the upper part of the beets and mix them with the soil. After ploughing, it would be well to disc again to cut up the lower part of the beets which are turned up. Preparation of ground containing frozen beets should commence at the earliest possible date, early in March or sooner if soil conditions permit. The longer the beets are mixed with the soil and undergo decomposition, the better for the yield of the following crop if it can still be planted timely. Thus handled, there seems to be no valid reason to believe that another beet crop might not be planted on such land, *provided that the beets frozen in were not subject to disease, such as nematode or various kinds of rot.* On the other hand, if the beets for any reason cannot be cut up and turned under early for planting of another beet crop in good time, a crop of barley might be more advisable than another beet crop on this land.

CULTIVATION COSTS AND RETURNS.

In the Report of The British Sugar Beet Society for 1929-30 it is remarked under this heading that : The cost of growing beet varies considerably, but it appears to be established that including reasonable transport and without credit for residuals, but including overhead charges, it should not exceed £18 per acre. The cost of producing 20 tons per acre is not necessarily greater than 10 tons, but the cash profit at the same sugar content is obviously more than double. In this connexion it may be useful to point out that with the continental seed which has to be used at present it is not wise to go for large roots, but the largest number of plants per acre compatible with proper cultivation. In 1912 Mr. COSSEY, of Raveningham, was paid by the Cantley Factory for 21 tons 17 cwts. to the acre, with rows 16 in. apart and singled to 10 in. in the rows. Mr. MEAD, of Dunmow, has grown in 1928 and 1929 on the

same land 22½ and 21 tons per acre containing 19 per cent. sugar, with rows 18 in. apart and singled to 6 in. in the rows. Mr. RANKIN, a strenuous advocate of wide drilling and singling, grew this year 13 tons per acre, whilst Mr. KETLEY, last year's Mason Cup winner, again grew 18¾ tons with closer spacing than last year. The Ministry of Agriculture advise about 18 in. between the drills by 9 in. in the rows. Cambridge University Department of Agriculture, in their report issued in 1929, state that narrow sowings show an average net profit of approximately £2 per acre over wide drills. Bristol University say : " Every effort should be made to get the rows as close together as is consistent with ease of interculture." Harper Adams Agricultural College and the Norfolk Agricultural Station indicate 18 in. by 10 in. as probably the best practicable spacing. Kirton Agricultural Institute's Report states that " Narrow drilling, say, 16 in. to 18 in. apart, will give better results than wide drilling. Plants should be singled to 9 in. apart."

YORKSHIRE TRIALS.[1]

A further series of trials under the Ministry of Agriculture Scheme of Sugar Beet Investigations was laid down in Yorkshire on similar lines to those which were conducted during 1927 and 1928.[2] Weather conditions during 1929 were on the whole favourable. Good seed beds were obtained after the severe frost, and germination was in most cases regular. Despite the prolonged drought it was only on the lighter and thinner soils that the crop suffered severely. Black Aphis (*Aphis runicis*) was again responsible for much damage as was also the Mangel Blister Fly (*Pegomya betae*). The results obtained generally serve to confirm those obtained during the two previous seasons.

The " Width of Rows " investigations conducted during the three seasons are in favour of the narrower rows. For practical purposes rows of 20 in. width which allow of efficient cultivation without undue damage to the plants appear to be most suitable. The " Quantity of Nitrogen " investigations have each season indicated that a definite increase in the yield of beet per acre can be obtained for extra nitrogen applied, up to as much as 4 cwt. per acre of sulphate of ammonia, the maximum amount used in the 1927 investigations. No effect on the sugar content has been noted and although the yield of tons has been increased with the extra nitrogen, this has not been out of proportion to the increase in the yield of beet.

The " Time of Application of Nitrogen " investigations carried out this season point to the desirability of applying all the nitrogen at the time of sowing. The results of the three years' trials, although not conclusive, do not indicate that there is any advantage to be gained by withholding half the nitrogen until after singling. Only in two of the thirteen investigations conducted in the three years were the heaviest yields obtained by withholding all the nitrogenous dressing until after singling. Regarding the variety trials, there was lack of agreement between the different centres as to those giving the highest sugar content and the highest yield per acre. On the other hand there was close agreement between the centres as to the percentage of " bolters " in the different varieties. In order of merit according to freedom from bolters, the following results were obtained at Fulford : Marster's Pedigree, Johnson's Improved ; P. Kuhn ; Garton Kuhn ; Delitzscher ; Kleinwanzleben, Schreiber, Dippe, Horning, Braune Elite, Mette, and Strube.

[1] Bulletin No. 164 ; published by the University of Leeds and the Yorkshire Council for Agricultural Education, 1929.
[2] See *I.S.J.*, 1929, 616.

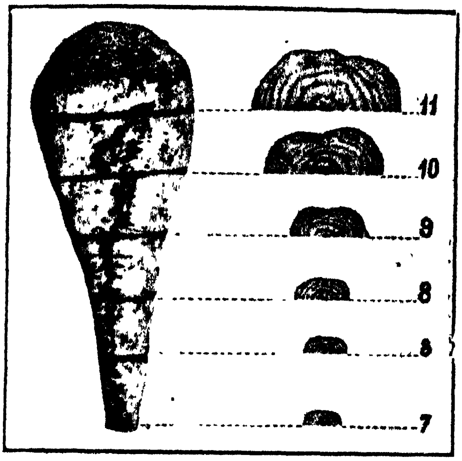
MISCELLANEOUS.

Some German Results.—HERMANN BARTELS[1] presents a thesis on various field tests made by him near Gutschdorf, Silesia, where on mild, humus loam with sand below a period of growth of 160 to 166 days was established. Good esults were obtained with spacings of 25 × 20 cms. (10 × 8 in.) and 37·6 × 26·7 cms. (14¾ × 10½ in.) but increasing the area per plant beyond 1500 sq. cms. (232 sq. in.) is not recommended for East Germany, otherwise yield, sugar content and juice purity are all adversely affected. In the manuring tests carried out, sulphate of ammonia gave uniformly favourable effects on good soils rich in lime and in humus. Natural and synthetic nitrate of soda had about equal values, the optimum dose being found to be about 4 dz./ha. (3cwt. per acre) but heavy doses of any form of nitrogen caused a considerable deterioration in the quality of the crop. Potash showed favourable effects on sugar formation, even with soils having a good content of K_2O. Lastly, it was noticed that amide nitrogen in the form of urea acted adversely both on yield and on quality. *Beet Seed Trials.*—Extensive field tests are made annually in France by E. SAILLARD, Chemist to the Syndicate of Sugar Manufacturers of Paris, and these are given a good deal of attention by reason of the care and impartiality with which they are conducted. In the latest reported,[2] 13 varieties were examined, and the four more important in each of the three series of trials, the average of 10 fields, were as follows : Sucrose content : Kuhn, 18·13 ; Dippe W. 1., 18·09 ; Sébline, 17·98 ; Hilleshog, 17·85. Yield of roots, kg. per hectare : Vilmorin B., 33·975 ; Buszczynski, 33·820 ; Rabbethge & Giesecke N., 33·015 ; Dippe, W. I., 32·670. Sugar, kilos per hectare : Vilmorin B., 5·952 ; Buszczynski, 5·915 ; Dippe, W. I., 5·909 ; Rabbethge & Giesecke N., 5·876. In these results there is a certain amount of variation in regard to sugar content among the 13 varieties, viz., from 18·13 to 17·01 ; but in kilos of sugar per hectare the differences are small amongst the first six varieties. Kuhn and Sébline, which were 1st and 4th in sugar content, take only the tenth and eleventh places in kilos of sugar per hectare. *Shelling Beet Seed.*—After a very full review of the literature on this matter, V. STEHIK and FR. NEUWIRTH,[3] give the results of some of their observations. Removal of the hull of beet seed does not in general appreciably improve the germinating power, excepting in the case of hard-shelled varieties. It does not at any rate prevent *Phoma*. It is concluded that modern beet selection is capable of correcting nature in the direction of improving the germinating power. *Soil Examination Methods.*—Insufficient work has been done on comparing the MITSCHERLICH and NEUBAUER methods of estimating the nutrient content of the soil. JOS. PAZLER,[4] in making a comparative examination with 50 samples found with P_2O_5 by the two methods a generally good agreement. With a large content of $CaCO_3$, however, the NEUBAUER showed relatively lower results, especially with poor soils. K_2O examinations gave relatively less satisfactory results, the NEUBAUER being here the higher. Only with rich soils did the two methods give the same results. Clay has an important effect on the results : when this constituent was high, the NEUBAUER gave higher results than the MITSCHERLICH ; while when large amounts of $CaCO_3$ were present at the same time the results were double.

1 *Zeitsch. Ver. deut. Zuckerind.*, 1929, **79**, 553-590.
2 *Suppl. Circ. hebd.*, No. 2132 of 1930.
3 *Zeitsch. Zuckerind. Czechoslov.*, 1930, **54**, No. 24, 266-272.
4 *Ibid.*, 1930, **54**, No. 16, 153-170.

Beet Factory Technical Notes.

Beet vascular bundles.—The cross-section of a beetroot shows concentric rings, which denote the vascular bundles of the vegetable tissue. Wychinski and others have found that as the number of these rings increases, the sugar content also rises ; while V. Bartos and V. Stehlik in 1922 have examined siloed roots to ascertain the significance of the rings from the selection point of view. An account of this work is now presented.[1] It appears from their results that between the number of the rings, the size of the root, and the amount of sugar produced there exists a certain relationship. Further, that although the sugar content of the root rises with the number of rings, this is only so up to 13 to 14 (measured at the thickest part of the root) ; above this number it falls, the sugar content of roots of the 14 to 15-ring group being smaller. Fodder beets have only 6 to 7 rings. Groups having the greatest number of vascular bundle rings contain individuals having the longest vegetation period, i.e., late ripening roots. A question investigated is the effect of other factors, e.g., the soil, nourishment, weather, and length of vegetation. Data obtained on this indicate the effect of these factors on the number of the rings to be small. Nor does the size of the root make a difference. Vivien[2] has already recommended the number of the rings as an important factor in selection, though unfortunately this means demolishing the root, since it has to be cut through at the widest point. It also clearly follows from these tests carried out at the Seed Selection Station at Semcice by the author, Dr. V. Bartos, who is director there, that the largest number of rings corresponds with the greatest number of leaves, and also the greatest weight of leaves.



Yield Formulae.—Some yield formulae calculated by Kazimierz Smoleński, Director of the Central Laboratory for the Sugar Industry of Poland, Warsaw, were reported recently[3]; and these are now published in somewhat more detail.[4] (1) When the factory produces only white sugar, the yield of white sugar is : $Wb = (c - s_1)\ )\ 1 - \alpha K)$; while the rendement in molasses is : $m = \dfrac{100\alpha\,(c - s_1)\,(K + 1)}{B_2}$. (2) When the factory produces only raw sugar, the yield of raw sugar is : $Ws = \dfrac{100\,(c - s_1)\,(1 - \alpha K)}{Rd}$; while the yield of molasses from such a factory is $m = \dfrac{100\,(c - s_1)\,(K - 1)}{KB_2}\left[1 - \dfrac{(1 - \alpha K)C_2}{Rd}\right]$. (3) When on the other hand the factory turns out at the same time both white and raw sugars, then the yield of white sugar will

1 *Zeitsch. Zuckerind. Czechoslov.*, 1930, 54, No. 26, 289-296.
2 " Saccharogenie : Selection de la betterave à sucre " ; *Bull. Assoc. Chim. Sucr.*, 1920-21, 38.
3 *I.S.J.*, 1929, 85. 4 *Prace Centralnego Laboratorjum Cukrownic:ego*, 1926-27, 340-350.

be : $Wb = \frac{100E(c - s_1)(1 - \alpha K)}{100E + Rd}$; and the yield of raw sugar wL $Ws = \frac{100(c - s_1)(1 - \alpha K)}{100E + Rd}$; while the yield of molasses will be: $m = \frac{100(c - s_1)(K + 1)}{KB_2}\left[1 - \frac{1 - \alpha K}{100E + Rd}(100E + C_3)\right]$. In these formulae the letters denote the following: c, sucrose content of the cossettes; s_1, sugar losses up to boiling the 1st massecuite; $\alpha = \frac{100 - q_1}{q_1}$; q_1, purity of the 1st massecuite (nett, without return of the run-offs); $K = \frac{q_2}{100 - q_2}$; q_2, purity of the molasses; B_2, Brix of the molasses; Rd, yield of raw sugar; C_3, polarization of the raw sugar; and E, ratio between the yield of white and of raw sugar.

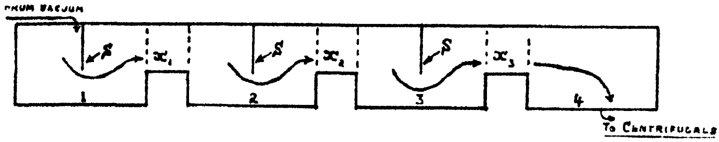
Minus-sugars.—Whether the dry period occurring during 1929 was one of the causes of beet polarizing higher than the truth is a question lately posed by J. ZAMERON, a French chemist of repute.[1] He had observed since the commencement of that campaign, a serious difference between the direct polarization of the roots and their actual sucrose content as determined by the HERZFELD-CREYDT and CLERGET methods. Thus from October 20th to November 9th he had found the following average figures: direct polarization, 15·86; HERZFELD-CREYDT, 14·77; and CLERGET, 15·08 per cent., from which one would conclude that levo-rotatory substances, so-called minus-sugars, must have been entering manufacture to the amount of 0·7 to 1·0 per cent. of the beet. In fact this loss had been observed also by a number of manufacturers, who may later (if not for the 1929 season) make it the reason for the insertion of a special clause in beet purchasing contracts, seeing that after all it is the actual sugar in the roots that is of interest, and not their polarization. Here are some of the figures published by Mr. ZAMERON in support of his observations:—

Material	Aqueous Digestion 85°-90°C.	Alcoholic Digestion	Sucrose Herzfeld-Creydt	Sucrose by Clerget	Raffinose by Creydt.
Beets, Oct. 20th, 1929	15·70	—	14·475	14·77	0·66
„ (1 hr., 75°C.)	16·20	15·50	—	—	—
„ Oct. 22nd, 1929	16·30	—	15·08	15·51	0·65
„ (1 hr., 75°C.)	15·40	14·50	—	—	—
„ Nov. 8th, 1929	16·50	—	16·03	16·04	0·25
„ Nov. 9th, 1929	15·60	—	14·97	15·03	0·34
Beet Juice, 1929	16·70	—	16·02	16·08	—
„ „ „	17·00	—	16·65	16·76	0·12
Fresh Cossettes, 1929	15·86	—	14·77	15·08	0·59
Molasses,[2] Oct., 1929	49·30	—	47·85	48·25	1·30
„ „ „	49·20	—	47·17	47·71	1·10
„ „ „	48·90	—	47·38	48·09	0·82
„ „ „	51·00	—	48·19	48·64	1·52
„ „ „	50·80	—	49·02	49·12	0·96

Heil's crystallizing process.—Articles have appeared lately in the German technical press discussing the conditions which should obtain when water is added to after-product massecuite for the removal of its fine grain. But P. KUHLE points out that it is much more important to know how one can

[1] *Bulletin de l'Association des Chimistes de Sucrerie*, 1930, 47, No. 1, 40-41.
[2] Reducing sugars content, 0·49 per cent.

avoid the formation of fine grain altogether.[1] His factory, Waghäusel i. B., Germany, during the past two years has operated the HEIL process,[2] which is said to give massecuites containing only well-formed, sharp crystals. In one of the two methods of boiling used, grain is formed from the green syrup, and this is purged through with a 60°Brix syrup of the next higher purity. The strike is finished off with the initial syrup, and let down with 5-7 per cent. of



water into the crystallizing apparatus sketched herewith. It consists actually of four crystallizers 1, 2, 3, and 4 (provided with stirrers), connected by cooling channels x_1, x_2 and x_3 so as to form a battery, each crystallizer being divided up by partitions, *S*, *S*, *S*. The massecuite enters crystallizer 1, and passes successively to crystallizers 2, 3 and 4, each fresh lot pushing the previous one before it, any mixing of the two being almost impossible. Some cooling takes place when the massecuite is passing over from one crystallizer to the next, this raising the supersaturation of the mother-syrup, so that when the mass has arrived in the next crystallizer it has time and opportunity to crystallize out as far as purity and concentration will permit. Altogether the duration of stirring is about two days. Finally the mass arrives in crystallizer 4, from whence it is dropped to the centrifugals at 50-52°C. Any water addition is quite unnecessary, and the molassses thrown off has a purity of at least 60°. An after-product sugar which is loose and on washing gives a liquor of 98·5 to 99° purity is thus obtained.

Sugar in press-cake. Researches have been described on the determination of sugar in the press-cake of Dr. CLAASSEN'S factory at Dormagen, Germany, according to which a remarkable difference was observed in the results found (*a*) by the ordinary method, and (*b*) by boiling out the sugar using plenty of water. A very much greater content of sugar was found by the second method.[3] This difference was explained to be due to the presence in the Dormagen cake of colloidal particles enclosing the sugar, the total amount of which sugar could only be liberated by heating up with an excess of water.[4] Now it is mentioned by Dr. O. SPENGLER, the Director of the Institute for the Sugar Industry, Berlin,[5] that the press-cakes of 20 German factories were examined by the two methods, but that only in two was more sugar to be found by the boiling-out method, and then nothing like so much as at Dormagen. There, however, the press-cake appears to be of a special nature, owing to the mode of clarification followed. In the same article under review Dr. SPENGLER describes tentatively a general method which he has worked out for the determination of sugar in press-cake which is expected to give reliable results under all conditions. It consists in the following procedure : 53 grms. of the cake under examination is placed in a clean, dry nickel flask provided with a cork covered with tin-foil ; or a wide-necked bottle with a tight-fitting glass stopper can also be used, though it is liable to break later when cooling. Either vessel is placed in a water-bath of 85-90°C., closed after a minute, and allowed to remain in the bath for an hour. At the end of this time, 177 c.c. of ammonium nitrate solution are added, the contents stirred with a glass rod until the cake is homogeneously distributed. Lastly the vessel is

[1] *Centr. Zuckerind.*, 1930, **38**, No. 7, 198-199. [2] *I.S.J.*, 1929, 446, 556. [3] *I.S.J.*, 1930, 204 [4] *I.S.J.*, 1929, 225, 440, 573. [5] *Zeitsch. Ver deut. Zuckerind.*, 1930, **80**, 69-80.

placed in a cold bath and the polarization taken. It is of course necessary to determine the dry substance of the cake beforehand, and to apply the corresponding correction.

Dutch factory data.—Beet sugar factories in Holland take part in a rigid scheme of mutual chemical control, and the figures extracted by C. W. SCHONEBAUM from recent returns to the A.T.V. concerning data for raw and thin-juices, thick-juice and molasses are of general interest :—

	Raw Juice		Clarified Juice		Thick Juice		Molasses	
	1929	1928	1929	1928	1929	1928	1929	1928
Purity	90·25	90·66	93·35	93·94	93·50	94·00	61·35	61·29
Ash per 100 Brix	2·50	2·49	2·23	2·13	2·22	2·06	12·58	13·04
Sugar per 1 of Ash	36·10	36·41	41·86	44·10	42·12	45·63	4·88	4·70
Sugar per of 1 organic non-sugar	12·45	13·23	21·12	23·90	21·85	23·86	2·35	2·43
Organic non-sugar per 1 of Ash	2·90	2·75	1·98	1·89	1·93	1·91	2·07	1·97

During the two years under consideration (actually in the original article the figures go back to the 1923 campaign) the sucrose content of the slices were: 1929, 16·94 ; and 1928, 17·69 per cent. Using the data of the above table, the following are the amounts of total non-sugar, ash, and organic non-sugar removed in the clarification for the same two years.

	Total Non-Sugar.		Ash		Organic Non-Sugar	
	1929	1928	1929	1928	1929	1928
Per 100 Brix in raw juice	3·10	3·49	0·27	0·43	2·83	3·06
Per 100 Pol. in raw juice	3·44	3·84	0·30	0·47	3·14	3·37
Percentage	31·80	37·40	10·80	17·30	39·20	44·70

MISCELLANEOUS.

Mechanical delays.—At the Mitchell factory, of the Great Western Sugar Co., Cal., during the 1929 campaign there was a total of 13 hours and 35 minutes "mechanical delays," of which 12 hours and 5 minutes resulted from the high sewer backing up in the elevator pit, and 32 minutes testing engine governors, which leaves 58 *minutes of actual mechanical delays*, all of which was spent in repairing one of the main engine drive belts. This is far better than any previous campaign at this factory and probably for any beet factory on record to date.

A CANCELLED ORDER.—According to the *Glasgow Herald*, the Portuguese Ministry of the Colonies, under a decision of the Court, is paying an indemnity of £8000 to Messrs. Duncan Stewart & Co. Ltd. of Glasgow, on account of the cancellation of a contract made with a previous Government for the erection of a sugar factory at Umbelu, Portuguese East Africa. The indemnity first claimed was £72,200, but the Government managed to get the sum reduced to £8000.

PORTUGUESE SUGAR DUTIES.—A modification of the Portuguese tariff on sugar imported into Portugal is announced. The special surtax at present levied on foreign sugar of any kind on importation is to be increased by 1 centavo per kg. when the price of sugar powdered by the Portuguese method, or above No. 20 D.S., in the cheapest European export market results in a price of less than 7 centavos (gold) per kg. c.i.f. Mozambique and Angola are given an undertaking that they will be permitted during the next 15 years to supply one-half of Portugal's total demands in sugar, but conditions are imposed in regard to the re-equipment of refineries and to the cultivation of the canefields, so as to ensure the stability of the industry.

1 *Tijdschrift*, 1930, No. 8.

Third Congress of the International Society of Sugar Cane Technologists.[1]

A Comparative Survey of Milling as practised in Cuba, Hawaii and Java.

By FRANCIS MAXWELL, D.Sc., M.I.Mech.E., F.C S.

Cuba implies large capacities with relatively low extraction, long trains and big units ; Hawaii moderate capacities with high extraction, short trains, and thorough preparation ; Java is somewhere in between. In Cuba the modern conception of efficient milling seems to tend towards trains of six mills (five at least), preceded by single or double crushers, the size of mills commonly being 36 in. × 84 in. In Hawaii and Java, where moderate capacity coupled with high extraction obtains, most factories are equipped with a plant consisting of a crusher and four mills with or without a shredder. The size of mills predominantly met with in Hawaii is 34 in. × 78 in. and 32 in. × 66 in. ; and in Java 30 in. × 60 in. and 32 in. × 72 in. Lately, however, Java has been forced with the rapid expansion of POJ 2878 to contemplate capacity problems.

Apart from capacities, the essential difference in principle between Cuba and Hawaii lies in cane preparation. Cuba relies on the aggregate "grinding" effect of her multiple crushers supported by deep-grooved 1st and 2nd mills ; Hawaii on knives and shredders co-operating with single crushers. As regards fineness of bagasse, on the whole the material entering the 1st mill in Hawaii is often equal to that entering the 3rd or 4th in Cuba, depending on the number of crushers and kind of grooving of the mills. Mill engineers seem to be in fundamental agreement that it is necessary to extract as much juice as possible in the earliest stage of milling, so as to render maceration more efficient and complete.

Knives.—About 80 per cent. of the mills in Hawaii have one or two sets of revolving knives, the first for levelling and the second for cutting and preparing. In Cuba the use of knives has only recently come into vogue; while in Java only two or three of the 179 factories use them. It must be remembered that in Cuba the cane cut into lengths of about 3 ft. is dumped on the carrier in car-loads, forming a tangled mass of great depth ; in Hawaii, though canes are not so short, similar conditions obtain, owing to a good deal of lodged cane and to mechanical unloading. Rational application of knives will there increase the capacity by 10 to 15 per cent., in cases of careless loading of the carrier, and naturally somewhat higher. In Java, however, canes by nature long and straight, are deposited on the carrier by hand or by a mechanical unloader supplemented by hand, forming even, regular and parallel layers, under which conditions knives are precluded from showing themselves to the best advantage. Though knives produce a considerable degree of preparation by the use of excessive power, their economic utility is confined to feeding purposes to give a more regular and even feed to the crusher. Cane preparation, in the true sense of the word, is the function of the shredder, usually in conjunction with the crusher.

Shredders.—Advantages of a modern shredder are : the thorough disintegration of the cane into fine shreds before entering the milling train proper ; the evening up of the feed to the mills; and the saving in power on the following mills. Shredding adds to both capacity and extraction. Addition of a modern shredder to an existing milling plant may be expected to increase the

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[1] Paper (here slightly abridged) published in the *Proceedings of the Third Congress of the International Society of Sugar Cane Technologists.*

capacity as much as 20 per cent. without affecting the extraction ; or to increase the extraction from 2·5 to 1 per cent., depending on the mills in the train. In excessively long trains as in Cuba (say a crusher and six mills) the economic importance of introducing a shredder is not so much the increase of extraction, as that the shredder enables one to discard a mill, or perhaps even two, if the opportunity afforded thereby to rationalize the method of maceration is taken.

Crushers.—Cuba is the stronghold of multiple crushers, whereas in Hawaii and Java single crushers form the standard practice. Exhaustive investigation in Java leads to the conclusion that the economic advantages to be derived from double crushers do not justify their adoption.[1] So far as the author's personal opinion is concerned, the tests in Java have confirmed the statement which he published a few years ago,[2] namely that "double crushers have no economic reason for existence." In Java the Krajowski is still the type of crusher met with, whereas in Hawaii there are both the Krajewski and the splitting type of crushers, but the tendency is towards 3-roller crushers. These are just common mills with the three rollers circumferentially grooved 1½ to 1¼ in. pitch at 60° angle, and so placed as to intermesh with one another. Under Hawaiian conditions this type achieves good results, i.e., about 75 per cent. extraction, if preceded by cane knives. Java has her own species of 3-roller crusher, created simply by substituting a "figured" or "toothed" crusher roll for the top roller of the 1st mill. This adaptation seems to meet admirably the conditions of feeding there, and accordingly there are a great number of such hybrid crushers in operation.

Grooving.—Apart from the number and size of the Cuban milling plants, it is indisputable that the adoption of deep grooves in the mill rollers has contributed a considerable share to the large capacities obtained. The common practice in Cuba is to groove the rollers of the mills ½ in. pitch throughout the train, except those of the 1st mill, which usually are 1 in. pitch. When dealing with very large capacities in long trains, the 1st and 2nd mills are often grooved 1½ and 1 in. respectively, or even deeper, thus actually constituting 3-roll crushers of the Hawaiian type. In Hawaii the standard practice may be taken to be for the first mill ¾ in. pitch for all three rollers and grooves intermeshing ; and for the other mills, front roller ¾ in. pitch, top and back rollers with seven grooves per in., the angle of the grooves being 55 to 60°. In Java, on the other hand, the standard practice remains shallow grooving or practically smooth rollers. Other cane countries, as the P.I., P.R., Queensland, and Natal, have also adopted the principle of deep grooving, Java standing alone in adhering to shallow grooving. In that country its adoption will be particularly beneficial in dealing with the hard POJ canes. Deep grooving contributes to an increase in capacity and extraction by increasing the gripping surface, by facilitating drainage of the juice, and by the tearing action afforded by the differential speed between apex and base of the grooves.

Messchaert grooves.—Their function is solely to promote drainage of the juice instead of enhancing the gripping surface of the roller. In Hawaii, where originally developed, their use is universal ; there all lower rollers, except some front rollers of 1st mills, are provided with them, the dimensions proved to give the best results being : pitch 3 in., preferably 2 in. if possible ; depth, 1¼ in., preferably 1¾ in., and width, ¼ in. to $\frac{3}{16}$ in. Messchaert grooving is

[1] *Archief*, Report of Meetings of the Society of Advisers to the Java Sugar Industry.
[2] *I.S.J.*, 1926, 357-363.

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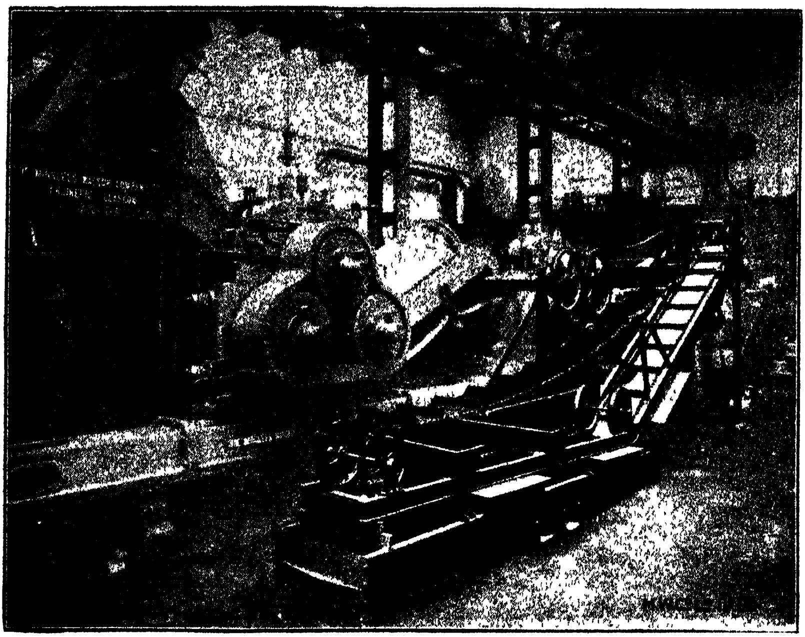

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gradually extending in Cuba, but the bulk of opinion in Java appears to be still unfavourable to this method. It is to be borne in mind that the full benefit of drainage grooves comes into play when the bagasse has reached a certain degree of disintegration, eager to absorb the maximum maceration liquid. If the cane still consists of large pieces, only partially broken up, the interstices in the bagasse blanket will in some measure afford drainage facilities, the Messchaert grooves being thus precluded from producing their full effect. When the early experiments were made in Java with these grooves, the bagasse leaving the last mill of a 14-roller plant had not in the majority of factories reached the same state of disintegration as the bagasse emerging from the 1st mill of a Hawaiian milling train provided with the above-mentioned preparatory devices. In the case of crushing the hard POJ varieties, this statement still holds good for a number of factories. But now in Java where shredding and intensified maceration obtain, opinions are veering in favour of drainage grooves, and the author ventures to predict that in the not too distant future this *modus operandi* will be generally practised.

Maceration.—Pouring the liquid in sheet form (juice) or spray form (water) upon the surface of the bagasse blanket is a most primitive and inefficient one. By judicious application of maceration or lixiviation, a considerable portion of the sucrose in the bagasse can be extracted more economically by other means than by brute force. The question now merely resolves itself into developing a cheaper apparatus for this purpose, and when this has been achieved the policy of long trains of mills will be definitely exploded. Nobel's hot maceration system appears to have given good results in several factories in Java, with which method a certain degree of disintegration of the cane is necessary. NOBEL's system is being applied between the penultimate and the last mill in trains without a shredder, but where a 14-roller plant includes a shredder, there is no reason (except a financial one for the present) why this "maceration carrier" should not ultimately be installed directly after the 1st mill. Thus one would be placed between the 1st and 2nd mills, another between the 2nd and 3rd, and yet another between the 3rd and last mills. Judging by the results already obtained, there seems to be no question that such a method of operation will achieve the maximum extraction while not affecting the capacity with only a few mills. Then there is the Naudet diffusion process, giving such admirable results in Egypt. "A train of four milling units combined with Naudet diffusion is actually achieving superior results (with a reasonably high capacity) to the longest of milling trains in use elsewhere, and coupled with this achievement is the considerable advantage of abolishing completely all settling tanks and filter-presses.[1]"

Modern Milling Plant.—A concrete milling problem, such as is now confronting quite a few factories in Java, may here be discussed on the basis of Hawaiian and Cuban experience. Assume a standard plant in Java consisting of a crusher and four mills, an increase in the capacity of which is required. Is it to be achieved by a pre-crusher, an additional mill, and perhaps yet another mill, or by other means ? The former policy may be one of the least resistance, but is not the most efficient nor the most economical to follow. The first steps that suggest themselves are : (1) applying the Hawaiian principle of deep roller grooving and Messchaert grooves ; and (2) the speeding-up of the units, especially the crusher, feeding devices of the roller type assisting materially. If greater capacity is required, the next step

1 *I.S.J.*, 1929, 180.

for consideration, in the author's opinion, is a shredding device of the modern type. As established in Hawaii, Egypt, and elsewhere, the increase in capacity with the same extraction that may be expected from the addition of a modern shredder is somewhere about 20 per cent. and in the case of hard canes appreciably higher. If necessary, the crusher preceding the shredder can be opened up, and the extra burden of breaking up the cane shifted to the shredder. To attain a high crushing rate coupled with a high extraction through the use of a shredder, it is necessary to adopt Messchaert grooves.

By the above means one can achieve economically a considerable increase of capacity while retaining the original basis of a crusher and four mills. Another step towards further increase in capacity is the application of one or two Nobel hot maceration carriers, by means of which a large proportion of the work of extracting sugar can be transferred from some of the mills to the maceration process. In consequence, the capacity of the plant can be further raised by opening up the units of the train. Summarizing, reason and experience indicate that a modern milling plant need only consist fundamentally of a crusher and four mills, supplemented by a shredder, roller feeding devices, and a system of hot maceration, the rollers of the mills being provided with deep grooving and Messchaert grooves. Under equal milling conditions with the same size of units, it is the author's firm opinion that such a plant would produce at least equal results in regard to capacity, coupled with extraction, as an installation of a double crusher plus five mills or one of a crusher and six mills.

Use of Live Steam in Tropical Cane Sugar Production.[1]

By H. A. FABER.

In the average American beet-sugar house fully 85 per cent. of the available sugar contained in the evaporator thick-juice is obtained directly as standard white granulated ; the remainder is recovered as high-grade meltings, which could be washed white. In continental European and Javan white sugar plants not more than 15 per cent. of the white sugar produced comes from the evaporator thick-juice directly ; the remainder is obtained by remelting. This increases the cost of producing white sugar considerably. Working under equal prices for labour, supplies, and equipment, it costs $11 more to produce a ton of white sugar by Dutch methods than by American methods for beet sugar.

USE OF EXHAUST STEAM.

In Java and in continental beet-sugar houses, white sugar is boiled by steam at the pressure of engine exhaust, or even by vapours issuing from the first effect of the multiple-effect juice evaporator. The temperature of such steam does not give a good circulation in the pans. The crystals move sluggishly, and the mother-liquor, which becomes super-saturated with sugar as concentration proceeds, is not adequately exhausted. Much false grain is formed and the syrup becomes very viscous. Crystallization nearly stops long before the mass is ripe ; then water is drawn into the pan in order to wash away the false grain and to lower the viscosity of the syrup. Another layer is added to the sugar crystals. Such crystallization at intervals causes some of the

1 Abridged from *Ind. & Eng. Chem.*, 1930, 22, No. 4.

viscous mother-liquor to get entrapped under each subsequent layer of sugar. Weak sugar crystals are the result and such sugar does not keep well in the warehouses.

On curing the white-sugar massecuite in the centrifugal, the mother-liquor (green syrup) is too viscous to leave the machines properly. The centrifugal delivers a mixed syrup of high purity but unfit for producing white syrup directly, which is boiled for re-melt. The thick-juice is boiled to grain and crystallized four times in order to recover all the available sugar. Only the first operation yields white sugar, the three subsequent boilings yielding remelt only.

The first three boilings are with low-pressure steam, but for the fourth live steam is used, as the viscosity has increased to such a degree that exhaust steam does not agitate it sufficiently. The mass is kept in closed crystallizers for a week, but it mats in the centrifugals ; and after the bulk of the molasses is purged away in one set of machines, the dirty sugar is mixed with pan supply syrup and cured again in a second set of machines. Then it is re-melted and mixed with the raw juice in order to be limed and purified again. The molasses that is not removed keeps on circulating.

The system of boiling sugar described above is identical with raw sugar practice. The production of white sugar depends here entirely on refinery methods— i.e., on remelting and repeated re-crystallization and on the use of decolorizing carbon. Decolorizing carbon is used extensively in Europe and should be used in Java, but costs prohibit. Although the juices are decolorized to a great extent, the sugar does retain a yellowish cast, which is corrected by the use of much ultramarine blue in the centrifugals.

Use of Live Steam in Boiling.

In American beet-sugar houses standard granulated sugar is boiled by live steam exclusively, and a considerable steam pressure is constantly maintained in the heating coils of the sugar pans. As a result of his observations on the white-sugar methods employed in Europe and Java, the writer has come to the conclusion that the steam pressure maintained within the coils of the sugar pan governs : (1) The amount of sugar extracted in one boiling (the percentage of sugar extraction in the pan). (2) The quality of the crystal. (3) The viscosity of the mother-liquor (the green syrup). (4) The amount of melting produced. (5) The cost of producing white sugar from either cane or beet.

A higher steam pressure, within limits of course, makes for more sugar, harder crystals, less viscosity, less re-melt, and lower costs of production. The writer advocates that live steam should now be used for boiling white cane sugar at the centrals. The use of live steam in this manner causes greater difference between the temperatures of the steam and of the boiling mass. A lively pan circulation ensues. The growing crystals move very freely through the massecuite and easily absorb all the sugar liberated as concentration increases. The mother-liquor does not get viscous and does not cling to the crystals, which are easily washed white. Fully 85 per cent. of the available sugar is now recovered as white directly out of the evaporator thick-juice ; the remainder furnishes high-grade seconds which can be washed to produce a second-grade white of excellent quality. Then there is no re-melt at all.

In the American beet-sugar houses all the available sugar is recovered in two boilings as compared with four in Europe. The American method requires much less factory equipment, labour, and supplies, and is cheaper to

operate. It is easily adapted to cane work. White cane granulated thus made is in all respects identical to the standard beet granulated in America, and is much superior to the best Java white produced. One hundred pounds of this white cane granulated can be delivered for the cost of producing raw sugar plus 8 cents.

THE GLENDALE EXPERIENCE.

About twenty years ago the owners of the beet-sugar factory at Glendale, Ariz., decided to grow sugar cane instead of beets ; they imported seed cane from Sinaloa, Mexico ; they brought mill equipment from Louisiana.

Their cane juice was purified by the Javan acid thin-juice method (according to HARLOFF and SCHMIDT). But for the recovery of the sugar all resemblance to Javan methods ceased ; the evaporator thick-juice was boiled to white sugar in the same manner as had been done with the beet juice, and the results were the same. Fully 80 per cent. of the sugar contained in the thick-juice was recovered in first jet as a standard white granulated. This sugar kept in the warehouse without difficulty even in that hot climate. The green syrup was boiled to grain ; it delivered seconds of a good quality and molasses which was well exhausted.

At that time the writer did not realize that he had accomplished something which was ahead of the best Javan white-sugar practice. He simply believed that he had equalled the Javan results, never dreaming that the work of the Javan sugar department is much inferior to the American practice of making white beet sugar. He did not know then about the handicap caused by the use of exhaust steam for boiling white sugar and the troubles experienced in Java on this account.

Later investigations revealed to him that the costly and intricate juice purifying methods of Java become entirely superfluous and obsolete as soon as the pan floor is operated according to American beet-sugar rules. Equal results are easily obtained if the evaporator syrup of any well-equipped raw-sugar house is re-limed and sulphured to a certain degree. It is then easily filtered through Vallez thick-juice filters and a very clear and brilliant pan supply liquor is obtained. Such standard white cane granulated is very much superior to Java white ; it keeps better upon storing, and it costs much less to produce.

In fitting up a raw-sugar house for such white-sugar work, several provisions can be made for furnishing the live steam for sugar boiling and for decreasing the amount of engine exhaust produced. About 90 lbs. of live steam are required to boil 100 lbs. of white sugar. In saving this amount on the steam consumption of the power plant, the engine exhaust is decreased by a like quantity. Diesel motors could be installed to supplant part of the steam power. For a motor-driven mill house all the power could be generated by Diesels, thus avoiding the production of any exhaust steam. In this case pressure evaporators fed by live steam should be used for concentrating the juices. An important portion of the bagasse is then left unused. It becomes available to firms who make paper pulp out of bagasse and affords a source of income, independent of the sugar market, to the owners of the central.

BEET CROP PRIZES.—Awards have been made to beet growers under the Education and Research Programme organized by the Ministry of Agriculture and the Beet Sugar Factories Committee. A silver cup was presented to Mr. F. G. W. DARBY, of Pymoor, Bury St. Edmunds area, for growing, or making the best effort to grow, the best crop of the year. His net tonnage per acre was 21·6 with a sugar content of 17·3, making 8380 lbs. of sugar per acre.

Publications Received.

Rate of Deterioration of Sugar Content of some POJ Sugar Cane Varieties in Louisiana. G. B. Sartoris. Circular No. 97 ; U.S. Department of Agriculture, Washington. (Superintendent of Documents, Washington, U.S.A.). 1930. Price : 5 cents.

Contents.—Introduction, weather conditions, and cold resistance, soil types and cold resistance, comparison of standing and windrowed cane (early and late windrowed canes), deterioration tests (cane cut for the mill, burned cane), loss in weight due to evaporation, stubble deterioration, stubble shaving, effect of frozen cane on stubble, rôle of POJ 234, general considerations, summary.

Reports of the Progress of Applied Chemistry. 1929 ; Volume XIV. (Society of Chemical Industry, Central House, London, E.C.2.). 1930. Price : 7s. 6d. to Members ; 12s. 6d. to non-Members.

We are pleased again to notice the publication of these Annual Reports, the value of which is now generally well appreciated by chemists. Messrs. EYNON and LANE again contribute the section on Sugar, and in it give a very good account of the literature of our subject published during 1929. A particularly useful section is that contributed on "Soils and Fertilizers" by Dr. E. M. CROWTHER, of Rothamsted Experimental Station, and chemists concerned with agricultural questions would do well to read it. Other sections to which attention may be directed are those on "Plant and Machinery" by R. EDGEWORTH-JOHNSTONE, and "Fermentation Industries," by H. LLOYD HIND and F. E. DAY.

The Profitable Use of Fertilizers. (Imperial Chemical Industries, Limited, London, and sales offices throughout the U.K.).

This pamphlet gives information for manuring various crops grown in the U.K. In regard to beets, acidity if present should first be corrected by the application of 1-2 tons per acre of carbonate of lime ; dung if available should be applied as early as possible. At the time of drilling apply also : 2 cwt. of sulphate of ammonia, or nitro-chalk ; 4 cwt. of super-phosphate ; and 2 cwt. per acre of 30 per cent. potash salts. As a top dressing, apply one or two applications of 1 cwt. per acre of nitro-chalk, the first immediately after singling, and the second not more than three weeks later.

Red-Squill Powders as Raticides. By J. C. Munch, James Silver, and E. E. Horn. Technical Bulletin No. 124 ; United States Department of Agriculture, Washington, D.C., U.S.A.). 1930. Price : 10 cents.

Contents : Sources of Squill ; Use as Rat Poison ; Preparation of Powder ; Effect on Rats ; Suggested Method of Preparation of Toxic Powders ; Literature cited. It is pointed out in this Bulletin that powders prepared by directly drying unfermented, sliced, red (not white) squill bulbs in an oven at 80°C. are usually more toxic than those prepared under other conditions. The lethal dose is about 250 mgrms. per kilo. of body weight for white rats, and somewhat less for the brown rodents. Cats, dogs, chickens and pigeons are not seriously harmed by squill powder.

The Analysis of Commercial Lubricating Oils by Physical Methods. Department of Scientific and Industrial Research ; Lubrication Research, Technical Paper No. 1. (H.M. Stationery Office, London). 1930. Price : 1s. 9d.

This report records the results of an attempt to analyse the properties of commercial lubricating oils by physical methods (viz., the measurement of the effect of temperature upon boundary friction in the presence and absence of oxygen). Such methods have now been in use for more than ten years, and by means of them it is possible to deduce the general "make-up" of an oil.

Brevities.

Hand Refractometer.—The hand refractometer is coming into use extensively by farmers for carrying out tests for estimating the ripeness of the cane. A determination indicating the dry substance content can be carried out in a few minutes in the field by an untrained assistant.

Protected Industry and Consumers' Prices.—In the flood of argument in the press following on the publication of the West Indian Sugar Reports the instance was quoted of a Continental country where the cost of production is £14 per ton, the price to the consumer is £25 to £30, and the export price f.o.b. is £6. 15s. This presumably refers to Czecho-Slovakia.

Java Sugar Assortments.—During 1929 the percentage production of different assortments in Java was as follows[1]: S.H.S. (superior head-sugar, No. 25, or Java whites), 67·28; S.S.S. (superior soft sugar or soft whites), 0·43; H.S. (head-sugar, No. 16 and up), 23·58; muscovados, Nos. 12-14, 4·69; and molasses sugars, 3·83 per cent. S.H.S. has been gradually increasing its quota from 53·66 per cent. in 1921, having been 54·45 per cent. in 1924 and 65·54 per cent. in 1928.

A Diesel Tractor.—In some tests in California[2] ploughing was done by (*a*) a machine consuming gasoline at 13½ cents. per gall., and (*b*) a Diesel-powered tractor using fuel oil at only 5 cents. per gall. The acres per day covered were (*a*) 18, (*b*) 25; gallons of fuel used (*a*) 65, (*b*) 45. Whereas in the case of the gasoline machine, the cost of fuel per acre worked out at \$0·487, in that of the other it was only \$0·09. Each drew four 20 in. ploughs, turning up the soil to 12-14 in.

Morgan Disintegrator.—It is claimed for the Morgan Cane Disintegrator[3] that it delivers cane to the rolls in a form which lends itself most readily to milling; and that the long staple fibre and mat-packing account for the remarkably small amount of "cush-cush" discharged from the mills. Also that the shearing action of the rotor separates the cane fibres lengthwise and ruptures the cane cells at the same time, thereby ensuring a thorough diffusion of the maceration water with the cane juice.

European Beet Crop Yields.—At the Bucharest meeting of the 14th International Congress of Agriculture,[4] figures stated to be averages for the yields of beet and of sugar for different European countries were presented. These calculated in long tons of beet per acre, and lbs. of sugar per acre are as follows: Czechoslovakia, 10·6, 3954; Belgium, 11·4, 3810; Austria, 9·1, 3660; Holland, 12·2, 3615; Denmark, 11·9, 3615; Germany, 10·0, 3508; Sweden, 10·8, 3428; France, 9·8, 3152; Italy, 11·1, 3152; Poland, 7·8, 2662; and Hungary, 11·4, 2413.

Synthetic Alcohol.[5]—A one month's (May, 1929) commercial test on synthetic ethyl alcohol was conducted at the plants of the Carbon and Carbide Chemical Company at Charleston, W. Va., U.S.A., and about 48,000 proof gallons was produced. It is stated that this run was a commercial success and that plans are under way for a larger production of synthetic ethyl alcohol. It is stated that the Carbide's production will be at the rate of 5,000,000 to 6,000,000 gallons per year, of which 20 per cent. will be used in the company's own operations. Domestic costs of synthetic alcohol are not known. Estimates indicate a cost of 35 cents per gallon.

Bagasse as Fodder.—W. P. Naquin, manager of Honokaa Sugar Company, Hawaii, describes[6] the feed now being used for the work animals of that plantation. It is composed of dry, screened bagasse, molassses and soya bean oil meal in the proportion of 100-100-50. No other feed is used. It is used at the rate of 3 lbs. for each 112 lbs. of live weight of animal per day. The results are reported to be entirely satisfactory, the animals showing a slight gain in weight since this mixture has been put into use. The cost of this new feed amounts to about 25 cents per animal per day, the average saving being close to \$50 per animal per year.

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[1] *Proefstation mededeelingen*, 1930. [2] *Hon-Iron*, January-February, 1930.
[3] It is built by the General Electric Co., and the sole selling agents are Petree & Dorr Engineers, Inc. See page xix.
[4] *Circ. hebd.*, 1930, 42, 91. [5] *Chem. & Met. Eng.*, March, 1930.
[6] *Hawaiian Planters' Record*, XXXIII, No. 4.

Review of Current Technical Literature.[1]

Some Important Variations in the Quality of Raw Cane Sugars. **E. W. Rice.** *Facts about Sugar*, 1930, **25**, No. 12, 290-291.

Of the impurities present in raw cane sugars, the organic matter (which rarely exceeds 1·5 per cent.) has the most decided influence on the refining quality containing as it does all the vegetable colouring matter and the colloids. For the purpose of comparing the effect of these impurities in refining, six cane sugars widely differing in colour were examined with the results shown below : while at the same time the colour before and after char filtration, the variation in the colour absorbed during char filtration, and the *Q* absorption values before and after char filtration, were determined :—

Sample No.	1	2	3	4	5	6
Chemical Analysis.						
Polarization	96·21	97·12	96·41	96·86	96·60	96·20
Glucose	1·41	1·14	1·07	0·98	—	1·05
Ash	0·50	0·37	0·47	0·51	0·45	0·56
Organic matter	1·29	0·70	1·01	0·97	—	1·30
Elliott Filtrability.						
	55·10	71·70	50·00	56·60	52·00	57·20
***pH* (Electrometric).**						
	5·95	6·02	6·01	6·18	6·21	5·91
Colloids (Dye Number).						
Original	410	310	395	285	350	292
1st off char	75	35	140	45	85	120
8th off char	100	115	210	90	140	200
Colour (Peters Units).						
Original	109	143	176	218	302	351
1	1·7	4·5	5	4	7	10
2	3·4	6	8	6	15	15
3	5	7	12	9	27	30
4	6	8	17	15	39	57
5	8	9	23	24	47	67
6	12	10	47	35	54	84
7	18	13	49	44	70	126
8	20	14	54	52	81	131

Per Cent. Colour Adsorbed by Char.

Screen =	560	440	560	440	560	440	560	440	560	440	560	440
1	98·5	97·8	96·8	97·1	97·0	97·0	98·2	97·2	97·8	97·7	97·2	96·4
2	96·9	96·5	95·8	95·4	95·5	95·2	97·3	95·7	95·0	94·0	95·7	93·6
3	95·4	94·5	95·1	94·3	93·2	92·5	95·8	93·5	91·2	89·3	91·4	87·4
4	94·5	90·6	94·4	93·0	90·4	86·9	93·1	87·8	87·1	83·3	83·8	77·1
5	92·6	87·5	93·7	90·3	87·0	82·2	89·0	81·5	84·4	78·0	80·9	74·2
6	89·1	84·3	93·1	87·5	73·4	71·7	83·9	75·2	82·2	75·8	76·1	67·5
7	83·5	76·5	90·8	84·4	72·3	68·7	79·8	71·4	76·8	69·9	64·1	51·7
8	81·6	75·4	90·2	79·0	69·3	64·0	76·3	69·5	73·2	67·4	62·7	48·5

***Q* Values.**

Original	3·39	2·71	3·24	2·92	3·31	2·95
1	3·30	2·56	3·44	3·46	3·43	3·81
2	3·91	3·24	3·42	4·67	4·02	4·44
3	4·12	3·71	3·52	4·44	3·90	4·34
4	6·04	3·50	4·57	5·20	4·36	4·17
5	5·09	4·32	4·50	4·88	4·71	4·00
6	5·82	4·63	3·61	4·53	4·55	4·02
7	4·71	4·53	3·87	4·13	4·29	4·02
8	4·57	5·67	3·99	4·02	4·07	4·11

Starting with No. 1 and No. 6, nearly identical analyses are found with about equal quantities of "organic matter," which filter equally well, yet No. 1 has 40 per cent. more colloids than No. 6 before going on the char. After char the relation is reversed, and No. 6 has 100 per cent. more colloids in the 8th portion than has No. 1. No. 6 has 320 per cent. as much colour as No. 1 before char filtration and this increases to over 650 per cent. in the 8th portion off, and the Q values show that a different character of colouring matter is present in the two sugars. Turning to Nos. 1 and 2, there is a large difference in the analysis and the small "organic" in No. 2 is logically followed by a high filtration, yet with 85 per cent. less organic there is only 32 per cent. less colloids in No. 2, and in spite of its high polarization it has 43 per cent. more colour, which colour is removed, if the average of all coming off is considered, to a considerably greater degree. Their Q ratios show a large difference in the character of the colouring matter. Nos. 3 and 4 are very much alike in every characteristic except in colloid content, and here is found the greatest difference in colloids among the samples after char, an original difference of 39 per cent. of 3 over 4 increasing to 211 per cent. in the first off and 133 per cent. in the last off the char. Again the Q ratios of the raws follow the colloid quantity rather than the colour units, and this is true of all the samples, the three lowest in colloids having the lowest Q ratio. This may indicate a variation in the colloids or the colour, or both, since caramel and many other colouring substances are colloidal. Nos 5 and 6 indicate this difference in character, for No. 6, with its lower colloids, is not more effectively decolorized, apparently because the colloid is of a class that is not readily adsorbed by char. Observation of the relations of test results to plant operation indicate that the Elliott filtrability test shows very closely the relative equipment necessary to clarify different raw sugars, and that the colour adsorption test shows the removal of colour to be about in inverse porportion to the Peters units. It seems impossible that the variations in the constituents composing the organic impurities can be due to fundamental characteristics of the original juices. The answer as to whether these differences in raw sugars can be eliminated without prohibitive expense seems to be found in the fact that high quality sugars are produced year after year by large and apparently prosperous companies.

EXPERIMENTS WITH FINAL MOLASSES (VALUE OF THE GLUCOSE/ASH RATIO). **J. A. Macdonald.** *Memoirs of the Imperial College of Tropical Agriculture, Trinidad*; *Sugar Technology Series, No. 2.*

An analysis of 20 samples of final molasses from two Trinidad factories was made, the following being the determinations tabulated : Solids (refractometer), Brix, sucrose, glucose, ash, pectins, pentosans, total colloids, total nitrogen, electrical conductivity, surface tension and viscosity. In determining the surface tension, TRAUBE'S "Stalagmometer" was used, and the following figures obtained : final molasses, 41·46 ; pure sucrose solution, 60°Brix, 73·8 ; final molasses at 25°Brix, boiled and filtered, 58·22 ; and the same final molasses after treatment with activated carbon, 67·45 dynes per cm. It is believed that s.t. measurements may be of great value : (1) for estimating the purifying value of carbons : (2) for determining the comparative refining quality of raw sugars ; and (3) for comparing the merits of clarifying agents. Conductivity determinations were made on 50 per cent. and 5 per cent. solutions of Trinidad molasses, and the figures tabulated with those showing the ash per cent. by incineration, an average ratio of conductivity to ash per cent. being calculated. Multiplying the electrical conductivity of each sample by this average ratio, a figure was obtained representing the electrometric ash of each sample. It was found that a more constant relation between ash and conductivity is obtained for the 5 than for the 50 per cent. solution.

Indeed the electrometric ash calculated from the conductivity of the 5 per cent. solution agreed fairly closely with the ash by incineration, the maximum difference between the two figures being in the neighbourhood of 4 per cent., whereas for the 50 per cent. solution it averaged about 8 per cent. Results were obtained demonstrating the value of the ash per cent. for judging the exhaustion of a molasses, since certain samples though having high purities were nevertheless exhausted, these high

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purity values being correlated with a high ash content and a low percentage of reducing sugars. If the glucose/ash is below 1·9, a high purity final molasses can be expected. Generally in raw sugar factories only the apparent purity of final molasses is determined. This figure is apt to be misleading as it does not indicate whether all the available sucrose has been extracted or not. A cane molasses of 40° a.p. may be completely exhausted; while another of 35°a.p. may still contain some available sugar. A better control could be obtained if the total sugars were also determined. Viscosity of the molasses was found to increase as the crop proceeds. Colloidal matter (as represented by the alcohol precipitate) was found to vary about 10 per cent. in the molasses of one factory, but was about 6 per cent. in the case of another. Refractometric solids approximate much more closely to the true solids than the degree Brix, and its determination is a simple and rapid procedure.

QUEENSLAND RESULTS. **Norman Bennett.** *Aust. Sugar J.*, 1930, **21**, No. 10, 610-613. In 1928 there were 35 mills in operation, and following are average figures; tons cane, 3,736,683 tons; tons cane p.t. 94 n.t. sugar, 7·18; fibre, 12·50; pol. per cent. cane, 15·42; bagasse moisture, 52·6; bagasse pol., 3·12; sugar pol., 98·36; sugar moisture, 0·40; gallons molasses p.t. cane, 4·27; gallons clarified juice p.t. cane, 223; purity 1st expressed juice, 89·11; purity clarified juice, 88·47; purity syrup, 88·88; Brix of syrup 67·86; pol. in sugars per cent. pol., in cane, 86·57; pol. extraction, 94·19;; extraction ratio, 0·461; milling loss, 7·17; pol. in sugar per cent. pol. in mixed juice, 91·91. Note that the average tons of cane per ton of 94 n.t. sugar, recorded above, viz., 7·18, is the lowest figure recorded to date for any cane sugar producing country. Molasses sold to distilleries, 30·2; burnt as fuel, 30·4; food for stock, 14·9; used as manure, none; otherwise used, 3·4 per cent.; and run to waste, 21·1 per cent.—INSULATION OF HEATED SURFACES (BOILERS, PIPES, ETC.). **J. S. F. Gard and R. S. Robinson.** *Paper read before the Society of Chemical Industry, Chemical Engineering Group.* A classification of insulators is given showing the advantages and disadvantages of each. Cork board, for example, though having a very low conductivity, is not fire-proof. Wood pulps, straw board, and the like have a moderate conductivity, but absorb moisture, and are not vermin-proof. "85 per cent. Magnesia" (i.e., magnesia and asbestos fibre) for temperature ranges 200 to 700° F. is considered very satisfactory, having a low conductivity and being free from the disadvantages attached to most other materials. Good diatomite compositions free from fibre, though having a higher conductivity, have a good classification. For the conductivity measurements a length of standard steam barrel, heated by an electric element varied by rheostats, was used, the temperature measurements being made by thermo-couples. Examples were given of the cost of application and the saving effected for boilers and steam lines.—COLORIMETRIC H-IONS MEASUREMENTS. **S. F. Acree and Edna H. Fawcett.**[1] *Ind. and Eng. Chem.* (*Analytical Edition*), 1930, **2**, No. 1, 78-85. It is shown that precision *pH* data in very dilute or weakly buffered solutions can be obtained colorimetrically only by: (*a*) the adjustment of the *pH* of the standard indicator solutions; (*b*) the use of iso-hydric methods; (*c*) the use of "super-pure" *pH* 7·0 water; and (*d*) correction for the salt and protein errors. The unknown solution and the indicator solution are said to be iso-hydric when they have the same *pH* value, and are sufficiently dilute to be free from salt and protein errors.

J. P. O.

RAPID ANALYSIS.—A scheme for carrying out the analysis of a beet molasses in the shortest possible time has been drawn up by Dr. V. KONN,[2] only one weighing being necessary for five determinations. He weighs out 26 grms. of the sample, and makes up to 200 c.c. with distilled water adjusted to 7·0 *pH*; 20 c.c. of this serves for the alkalinity determination, and 10 c.c. for the *pH*, colorimetrically or potentiometrically; another 20 c.c. are made up to 200 c.c., filtered, and used for the estimation of colour; while 10·4 c.c. are made up to 100 c.c. and used for the determination of the ash conductometrically. Lastly, 100 c.c. are treated with 3·5 grms. of basic lead acetate, filtered, and polarized.

[1] Bureau of Standards, Washington.
[2] *Zeitsch. Zuckerind. Czechoslov.*, 1930, **54**, No. 30, 325.

Review of Recent Patents.[1]

UNITED STATES.

RIPENING SUGAR CANE IN SUB-TROPICAL COUNTRIES. **Denis P. J. Burguieres,** of Louisa, La., U.S.A. 1,746,190. February 4th, 1930.

Where cane is grown in sub-tropical countries, such as Louisiana, Texas, Argentina, and Australia, the canes frequently do not ripen at all, but are usually killed before maturity by frost, and the process of ripening is prematurely affected by the advent of cool or cold weather, which affects the formation of chlorophyll in the leaves of the growing cane, and checks the growth of the stalks causing the increase of sucrose contents therein, or ripening the cane. When the weather continues warm, and the warm spell is followed by a freeze, the cane does not ripen at all, and remains green, possessing a relatively small sucrose content.

According to this invention, however, one can artificially check the growth of the stalks by supplying to their tops a material which attacks, but does not destroy the " bud " of the cane, and which retards the formation of chlorophyll in the leaves. This arrested growth results in the material increase in the sucrose contained in the stalks after such treatment. Suitable substances for this purpose are mixtures containing lime, caustic potash, common salt, weak solutions of sulphuric or hydrochloric acid and certain other solids, liquids or gases. These substances may be applied in the powdered form, as with unslaked lime sprayed over the tops of the growing plants or may be applied in the form of liquid sprays, such as a saline solution or weak acid solution. If applied in the solid form in the shape of a powder, this will sift down into the bud, and will become moistened by dew or rain. If in the form of a liquid spray, the peculiar formation of the cane top will cause this spray to run down into the bud of the cane and arrest its growth.

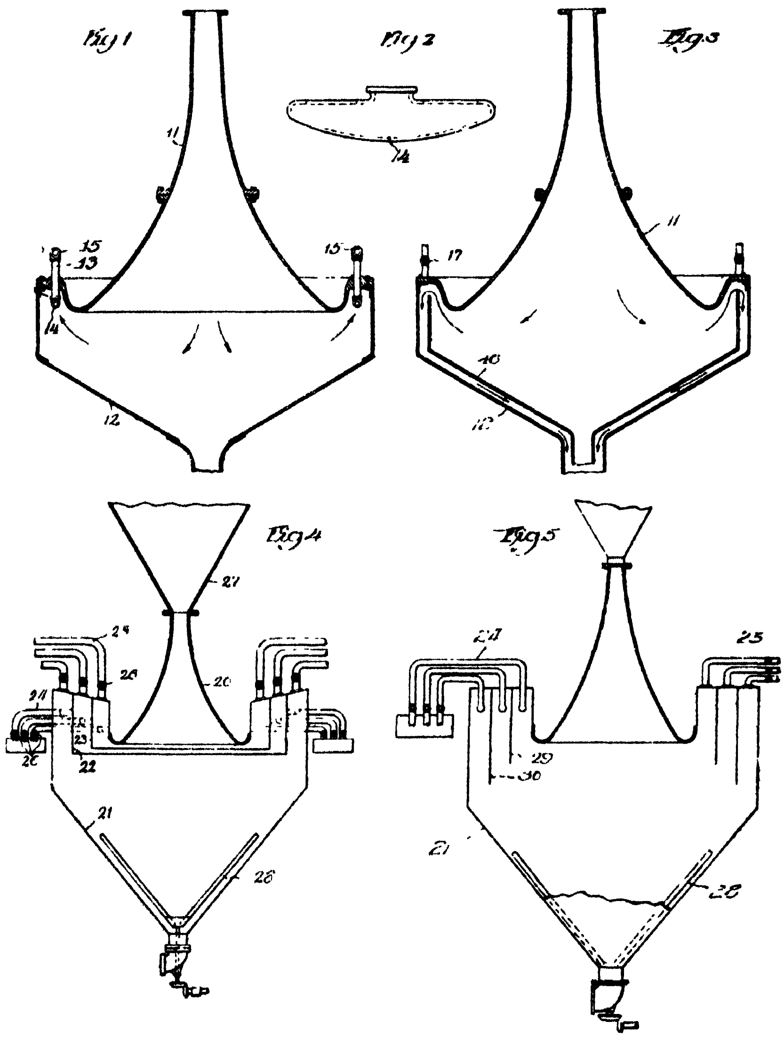
Such chemicals may be applied by airplanes, since the time when this treatment is desirable is when the cane is nearly ripe and the field becomes a tangled mass and it is difficult, if not impossible, to get through it on the land with any suitable device for spraying the tops of the stalks. While one treatment may suffice, several treatments with material may produce better results. Moreover, the strength of the material will vary according to the condition of the stalks. Of course, this treatment should only begin when the stalks have nearly reached full growth, or are nearly ready for the harvest, not upon stalks that are cut down and kept for " seed." When the material is dusted on in the powdered form, it would be preferable to apply same in comparatively calm weather, either in the evening before the dew settles on the plants, or early in the morning, while the dew is still on the plants. Obviously only a small quantity of the active material need reach the bud of each plant to materially check the growth of, but not kill the plant. This checked growth, as before stated, will cause nature to devote part of the energy formerly expended in the development of the leaves in the production of sucrose in the stalks.

DEFECATING LIQUIDS (SETTLING TANKS). **Ashur U. Wetherbee** (assignor to **Gilchrist & Company,** Chicago). 1,733,324. October 29th, 1929.

Objects of the invention are: (1) to provide a gradually decreasing velocity of the moving body of liquid (e.g., cane juices) and a large cross-sectional area of the stream of the liquid ; and (2) to provide a process in which, despite such large reduction in velocity and large settling area of the liquid, the volume thereof and, consequently, the time during which said liquid is held in the receptable, is a minimum. The apparatus in Fig. 1 which is particularly effective for removing comparatively small volumes of sediment comprises preferably a closed tank. The upper part 11 is preferably in the form of a flaring nozzle or horn, while the lower part 12 of the tank is preferably of general conical shape. The clear liquid is drawn off through series of outlets which may be in the form of pipes 13 arranged at intervals near the

[1] Copies of specifications of patents with their drawings can be obtained on application to the following—*United Kingdom* : Patent Office, Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2 (price 1s. each). Abstracts of United Kingdom patents marked in our Review with a star (*) are reproduced from the *Illustrated Official Journal* (*Patents*), with the permission of the Controller of H.M. Stationery Office, London. Sometimes only the drawing or drawings are so reproduced. *United States* : Commissioner of Patents, Washington, D.C. (price 10 cents each). *France* : L'Imprimerie Nationale, 87, rue Vieille, du Temple, Paris. *Germany* : Patentamt, Berlin, Germany.

outer periphery of the tank, as shown. The lower ends of said pipes may have suction heads 14 and the upper ends connect with suitable draw-off pipes 15. Juice to be clarified enters through the small inlet at the top of the funnel and the sediment is drawn off through the opening at the bottom of the apparatus. As the juice descends, its cross-sectional area increases progressively, thereby rapidly reducing the rate at which the liquid flows toward the bottom of the funnel shaped enclosure until it is reduced to a minimum. The curvature of the side-walls is preferably such as to prevent the formation of eddy currents. As the liquid follows the outward curve of



the container, the direction of flow becomes gradually horizontal, resulting in a further decrease in velocity, but the sediment descends to the bottom of the tank and is not retarded in the same proportion as the liquid, due to its greater density and greater inertia. The amount of clear liquid drawn off may of course be regulated to prevent too strong a current in the tank. The multiplicity of outlets permits a substantially uniform distribution of the flow toward the periphery of the tank.

In Fig. 3, a slightly modified form of apparatus is shown in which the conical lower part of the tank is provided with a false bottom 16, the upper edge of which provides a horizontal overflow, thereby permitting the clear liquid to be drawn off

through the clearance space thus provided, the sediment being drawn off through the central opening. With this arrangement, the draw-off pipe at the bottom is restricted or regulated by suitable means so that the outside channel between the two bottoms may be maintained full of the clear liquid as the latter is slowly drawn off. A series of suitable vents may be provided for drawing off scum or releasing air or other gases. The operation of Fig. 4 in similar. The upper part of the tank 20 increases rapidly in cross sectional area from top to bottom, and the lower half 21 or conical tank is of a very large capacity with steeper sides than those above shown. A number of circular partitions 22 and 23 may be provided, arranged concentrically with reference to the main axis of the tank, forming separate chambers dividing the flow of liquid into a plurality of independent streams after they pass through the horizontal portion. With the arrangement shown, the streams flow upwardly, but their course could be diverted horizontally outward or diagonally upward or downward, as desired. Each chamber may have independent draw-off pipes 24 and independent pipes 25 for drawing off scum, both sets of pipes being controlled by suitable valves 26, or a common scum draw-off for all the chambers may be provided. The liquid may be introduced into the tank through a funnel 27 constituting a scum tank used for the removal of most of the scum as a preliminary operation. In conical tank 21, scrapers 28 may assist in removing the sediment through the bottom opening. Similar mechanical means may also be applied to the apparatus shown in Figs. 1 and 3. In Fig. 3 they may be located between the double bottoms or inside the inner bottom, or in both locations depending on the purpose for which the apparatus is used. The apparatus in Fig. 5 is similar to that in Fig. 4, except that the partitions 29 and 30 are of different lengths, whereby the outer partition extends farther down into the tank than the inner one, thereby drawing off the clear liquid from different vertical zones as it flows horizontally outward. This causes part of the liquid to descend lower in the tank before acquiring a horizontal flow than would otherwise be the case. In yet another form (Fig. 6, not here shown) the upper part of the tank has a somewhat different curvature, the cross-section showing a reverse curve as suggesting one of a number of possible modifications. In all forms of tanks, means may be provided for heating or cooling the liquid, located within or without the tank.

MANUFACTURE OF ALCOHOL, USING A MIXTURE OF MOLASSES WORT AND BAGASSE. **William L. Owen** (assignor to the **Citizens of the United States**). 1,748,791. February 25th, 1930.

Cane bagasse contains sufficient residual sugars to yield from 5 to 9 gallons of alcohol per ton, if fermented with the efficiency that is obtained, for example, in the fermentation of the sugars in final molasses, or blackstrap. Fresh bagasse when added in proportions varying from 1 to 10 per cent. to a molasses wort at 17 to 20°Brix density, gave an increase of alcohol equivalent to from 1·5 to 4·5 gallons of alcohol per ton of bagasse. Its addition to a fermentation molasses wort accelerates the rate of fermentation and shortens the period required for its completion to one-third that ordinarily required. It is possible thus to ferment molasses worts of considerably higher density than would be possible without the use of this accelerant. When used on worts of 35 and 40°Brix density the addition of bagasse has given increases in yields of alcohol amounting to as much as 13 gallons per ton over that obtained without its use. Furthermore, the fermentation is approximately completed in 70 hours in the presence of bagasse, where, in its absence, the fermentation is usually only one-half completed in 120 hours.

Details of the process are : Yeast is developed as under ordinary conditions in a yeast apparatus containing molasses wort and added nutrients at a density of 20° Brix. When the density of the wort has been reduced to one-half its original density, the seed yeast is transferred as under ordinary distillery practice to an intermediate or seed vat, where it is mixed with sterile molasses wort of approximately the same density as that of the yeast apparatus. In this seed vat wort there is added approximately 5 per cent. of cane bagasse which is sterilized within the wort. The seed yeast is allowed to come in contact with the sterile bagasse before the main volume of the fresh wort is brought in contact with it. This procedure has

been found to be quite necessary, for to obtain best results the seed yeast should be absorbed into the cellular portion of the bagasse. The explanation of this is that one of the principal advantages of the bagasse is in maintaining the suspension of the yeast cells throughout the fluid, and in causing a more rapid liberation of CO_2 gas, which in high concentrations is inimical to the development of the yeast.

The seed yeast is allowed to develop in the seed vat in the presence of the bagasse as under ordinary conditions, i.e. for 8 to 10 hours, although this period will be found to be shorter than that required where no bagasse is added. After the density of the wort in the seed vat has been reduced by one-half indicating the ripeness of the seed for use, the contents of this vat are transferred to the main fermenters as under ordinary practice in distilleries. The usual rate of seeding of the main fermenters is 5 per cent. by volume, but owing to the greater vigour of the seed when grown in the presence of bagasse this volume may be reduced by one-half without impairing the rate of fermentation or its final efficiency. When the fermentation is completed in the main fermenters, which will be found to be shortened by from one-third to one-half owing to the accelerating action of the bagasse, the fermented wort is pumped to the stills as under ordinary conditions, except that a suitable screen is placed over the pipe and the bagasse particles removed from the solution. The residual bagasse may now be washed, and dried and used over and over again, or it may be prepared for utilization in the manufacture of fibre board.

The primary object of this process of fermenting cane bagasse is to remove its residual sugars by the directed formation of substances of economical value, and to thereby prevent their utilization by micro-organisms which impair the quality of the fibre for board manufacture. After the sugars are removed by fermentation, the residual product is still susceptible of deterioration by fungi and other micro-organisms, so it is necessary to add some preservative. The substance used must be very cheap to make it practicable to use it on a commercial scale. Small amounts of acetic acid form a very efficient preservative for this purpose, in fact, the most efficient that could be found. The plan, then, is as follows: The spent bagasse from the main fermenters is conveyed to large vinegar generators and is inoculated with a culture of *B. aceti* by allowing a dilute vinegar solution to percolate through it. The alcohol absorbed by the bagasse is thus oxidized into acetic acid, and the bagasse, if it has developed as little as 0·5 per cent. acetic acid, may be stored indefinitely without deterioration. The material can now be dried in suitable dryers, or in the sun, and then baled for fibre board manufacture.

PRODUCTION, APPLICATION AND REVIVIFICATION OF ACTIVATED (DECOLORIZING) CARBON. (*A*) **Oscar L. Barnebey and the late Merritt B. Chaney,** of Detroit, Mich. 1,751,612. March 25th, 1930. (*B*) **John J. Naugle,** of Brooklyn, New York. 1,731,474. October 15th, 1929. (*C*) **Otto Fuchs** (assignor to **Holzverkohlungs-Industrie A.-G.,** of Constance, Baden, Germany. 1,753,507. April 8th, 1930. (*D*) **George Enssle** (assignor to **Holzverkohlungs-Industrie A.-G.,** of Constance, Baden, Germany.

(*A*) An improvement in the art of producing adsorbent carbon consists in treating carbonaceous material containing between 10 per cent. and 60 per cent. of its carbon content by weight of tarry matter with an oxygenated gas at reacting temperatures below 900°C.

(*B*) This specification concerns a method of treating comminuted materials in electric furnaces, and in the U.K. patent has already been dealt with.[1]

(*C*) A method of producing activated carbon comprising reducing carbonized material to particles of approximately uniform shape, size, and specific weight, and treating the same with activating gases for a comparatively short period of time at a temperature of approximately 900°C.

(*D*) A method of producing activated charcoal comprising treating charcoal with a mixture of gases, free of oxygen, containing at least 40 per cent. of carbon dioxide and a substantial component of a combustible gas.

[1] See U.K. Patents, 267,240 and 267,241; *I.S.J.*, 1927, 337.

VACUUM PAN. **Charles E. Rogers,** of Detroit, Mich. 1,746,795. February 11th, 1930. A vacuum pan comprises a shell of substantially uniform diameter throughout its height, a condensor within the shell at the top, said condenser consisting of an open trough shaped member near the top extending diametrically thereacross and having an outlet to the exterior of the shell, a water chamber thereabove less in width than the trough, the bottom wall thereof having a series of rows of apertures throughout its length and width for discharging the water into the trough, the marginal rows of the apertures being greater in number than the rows discharging centrally over the trough.—TREATING FIBROUS PLANT TISSUES. **D. R. Nanji,** of Headingley, Leeds, England. 1,746,842. February 11th, 1930. A process for the production of a lustrous fibre consists in heating bast tissues with a caustic soda solution of 1 to 4 per cent. concentration, the treatment being effected at a pressure of approximately 10 atmospheres and continued for a period of 20-60 minutes' duration.—SYRUP. **Julian K. Dale** (assignor to **Sun Maid Raisin Growers,** of California, of Fresno, Cal.). 1,746,993. February 11th, 1930. A method of refining a raisin-like syrup which comprises treating the extract from sugar-containing raisin-like fruits with an alkaline compound of an alkali metal to alkalinize the same.—RAISIN SYRUP. **Henry W. Denny** (assignor to **Sun Maid Raisin Growers,** of California of Fresno, Cal.). 1,746,994. February 11th, 1930. A raisin syrup is claimed substantially free from tartaric acid compounds.—TREATMENT OF DISTILLERY WASH. **Marcel Bernier, André Duriez, Francois Duriez, and Henri Schotsmans,** of Trezonnes, France. 1,747,538. February 18th, 1930. A process for the treatment of distiller's wash and other by-products and residues containing fermentable substances, consists in sterilizing said distiller's wash and the like, in adjusting their hydrogen ion concentration and in then submitting them to fermentation in a sterilizable closed vessel under the action of true acidaminolytic bacteria of the type of *Bacillus aminophilus*, the said hydrogen ion adjustment corresponding to the limits ranging from about $pH = 6$ to $pH = 8$ and being optimum selected for every fermentable substance in virtue of a previous test.—BEET CLEANER. **Abraham Gudmundsen and Austin Gudmundsen,** of Salt Lake City, Utah. 1,747,625. February 18th, 1930. A separator comprises a feeder, an inclined endless belt conveyor disposed adjacent to and below the feeder said inclined conveyor being adapted to cause certain of the objects dropped thereon to adhere thereto and other objects to slide or bounce therefrom, a fan-like impelling member rotating within a housing disposed adjacent to the bottom of the inclined conveyor adapted to receive objects not retained on the conveyor, an endless belt disposed adjacent to said impeller having pins secured thereto and projectionable beyond the same to enter objects thrown against them, an idler disposed adjacent to the top side of the lower run of said pin carrying belt adapted to bend the belt through an angle and to vibrate it, and means adjacent to the underside of the belt between rows of pins adapted to release objects from the pins.—BEET HARVESTER. **Roscoe C. Zuckerman,** of Stockton, Cal. 1,748,746. February 25th, 1930. In a vegetable harvester having a wheel supported frame adapted to travel along the ground, a vertically movable topping unit mounted in connection with said frame, manually operated means for thus moving said unit, and a support for the operator of said means mounted in close association with the unit.—MANUFACTURE OF ALCOHOL. **Wm. L. Owen,** of Baton Rouge, La. (assignor to the **Citizens of the U.S.**). 1,748,791. February 25th, 1930. The process is claimed which comprises the mixture of bagasse and a molasses wort, the sterilization of this mixture, the subjection of this mixture to the fermenting action of seed yeast until the yeast cells have become distributed upon the bagasse fibres and the wort has been reduced to one-half of its original density, and the transfer of this fermenting mixture to a body of molasses wort in which it is desired to produce alcoholic fermentation.—CENTRIFUGAL DRIERS. **Hans C. Behr,** of Scarsdale, N.Y. 1,749,368-1,749,370. March 4th, 1930. Apparatus for separating in two stages liquid from solids, comprises means for supplying a continuous stream of the material under treatment, a rotary screen, means for causing the material to move centrifugally over the screen with gradually increasing energy of rotation, a second stage embodying a rotary receiving device having a receptive capacity less than the natural rate of centrifugal delivery from the first stage, for impeding the movement over the screen in the first stage.

United States.

(*Willett & Gray.*)

(Tons of 2,240 lbs.)	1930. Tons.		1929. Tons.
Total Receipts, Jan. 1st to April 19th	667,446	..	1,322,617
Deliveries „ „	873,236	..	1,137,403
Meltings by Refiners „ „	869,765	..	953,892
Exports of Refined „ „	15,730	..	30,000
Importers' Stocks. April 19th	231,481	..	283,445
Total Stocks April 19th	394,546	..	531,680
	1929.		1928.
Total Consumption for twelve months	5,810,980	..	5,542,636

Cuba.

STATEMENT OF EXPORTS AND STOCKS OF SUGAR, AT MARCH 31ST.

(Tons of 2,240 lbs.)	1928. Tons.		1929. Tons.		1930. Tons.
Exports	899,297	..	1,333,984	..	193,223
Stocks	1,185,044	..	1,296.744	..	1,399,271
	2,084,341	..	2,630,728	..	1,592,494
Local Consumption..	21,141	..	25,038	..	14,382
Receipts at Ports to March 31st ..	2,105,482	..	2,655,766	..	1,606,876

Habana, March 31st, 1930.

J. GUMA.—L. MEJER.

Sugar Crops of the World.

(*Willett & Gray's Estimates to April 24th,* 1930.)

	1929-30. Tons.		1928-29. Tons.		1927-28 Tons.
CANE.					
America	8,824,333	....	9,190,564	....	8,147,901
Asia	7,325,879	....	7,315,485	....	6,891,715
Australasia	615,483	....	633,066	....	588,163
Africa	688,658	....	752,094	....	656,360
Europe	10,000	....	11,610	....	10,552
Total Cane	17,464,353	....	17,902,819	....	16,294,691
BEET.					
Europe	8,299,762	....	8,420,818	....	8,031,874
U.S.A.	901,713	....	938,640	....	965,241
Canada.............	27,869	....	28,857	....	27,212
Total Beet	9,229,344	....	9,388,315	....	9,024,327
TOTAL CANE AND BEET....	26,693,697		27,291,134		25,319,018

United Kingdom Monthly Sugar Report.

Our last report was dated 8th April, 1930.

On the 14th April by a unanimous vote it was decided to abolish the single selling agency for the Cuban crop. This has had a serious effect on the position of sugar, and holders in their anxiety have decreased their price to 1½ c.i.f. New York.

The Budget which was taken also on the 14th made no change in the sugar duties, although it had been forecast that some change might be possible.

The tone of the market since our last report has been flat and easier, especially in America. The Terminal Market has fallen 30 to 35 points. This was brought about by the Cubans, who could not sell their actual sugar and endeavoured to effect hedge sales on the Terminal market.

The Terminal Markets in London have been flat, especially for White Sugar. In the Raw Market May fell from 6s. 9d. to 6s. 1½d., August from 7s. to 6s. 5¼d., December from 7s. 3d. to 6s. 9d., March from 8s. 3d. to 7s. 9d. There were a few thousand tons tendered on the White Terminal contracts for May delivery, and this month sold from 9s. 6d. to 8s. 4½d., and August from 9s. 1½d. to 8s. 9d. The latest prices are :—

	MAY	AUGUST	DECEMBER	MARCH
Raw	6s. 1½d.	6s. 5¼d.	6s. 9d.	7s. 9d.
White	8s. 4½d.	8s. 9d.	9s. 4½d.	—

The trade have only bought sparingly, and there has been a general reduction in price. The refiners made two reductions of 3d. per cwt. on April 28th and May 8th, and their latest prices are, 21s. 7½d. London Granulated and 25s. 3d. No. 1 Cubes.

Business in Raw Sugar has been small. 96 per cent. sugars have been sold down to 7s., at which price there are sellers to-day for June shipment, and a fair quantity of Polish and Czecho beet sold from 6s. 9d. down to 6s. 6d. f.o.b.

Java has recently sold 40,000 tons, the balance of the old crop, at a parity of about 7s. 9d. f.o.b.

There is no fresh news from Europe and at present the sowings are proceeding in a normal manner.

Cuba is still accumulating sugar, and although the exports recently have been a little better, the stock in Cuba to-day is well over 3,000,000 tons.

ARTHUR B. HODGE,
Sugar Merchants and Brokers,

21, Mincing Lane,
London, E.C.3,
9th May, 1930.

THE

INTERNATIONAL SUGAR JOURNAL.

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☞ The Editors are not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

The Editors will be glad to consider any MSS. sent to them for insertion in this Journal, and will endeavour to return the same if unsuitable; but they cannot undertake to be responsible for them unless a stamped addressed envelope is enclosed

No. 378. JUNE, 1930. Vol. XXXII.

Notes and Comments.

F. O. Licht on the World Sugar Situation.

LICHT, the well known Magdeburg statistician, gives in his Monthly Report for June an interesting and instructive survey of the world sugar situation which, it must be noted, does not err on the side of optimism. He estimates the current crop production at a round million metric tons less than that of 1928-29, but then we are still suffering from the consequences of the latter crop being nearly two million tons larger than that of 1927-28. A survey of the visible stocks existing at April 1st last shows that they are by 922,098 and 1,816,592 metric tons respectively bigger than those existing at the same time in the two preceding years. This state of affairs must be attributed to the great over-production in 1928-29, for the surplus production that year corresponds almost exactly with the surplus of the stocks of 1930 compared with those of the year 1928; thus that surplus production, amounting to 1,965,000 tons, still has a bearish influence on the statistical position.

These visible stocks are of their present dimensions in part, also, because the invisible supply—the unknown quantity stored by traders and consumers—has probably been cut down to a minimum; the trade in the whole world is living from hand to mouth, and no one knows when the movement will start to replenish invisibles to their former level. Those facts are known to the market, but the psychological effect of the big figures of visible stocks is to steadily depress prices.

Another adverse factor is that consumption has lately stopped increasing for the time being, Europe during the last six months having registered a slight decrease, while in America development is proving below expectations. This factor if it persists through the year will merely offset the decrease in production and leave the visibles unreduced. Then the European beet crop looks like increasing by 100,000 hectares, which in the normal course may mean anything up to half a million tons extra of sugar next season.

LICHT next records the failure in Cuba of the Single Seller scheme, and considers that the principal fault in the venture was the omission to solve the financial problem before embarking on that scheme; but he doubts whether at best it could have reaped more than a limited success, owing to

the difficulties inherent in marketing the sugar on one basis in America and on another one outside that continent. Any attempt to squeeze the American market might have jeopardized the tariff preference. As it is, LICHT considers Cuba's position pretty hopeless, in view of her weak finances; conditions can only improve if she decides to adapt her production to the possibilities of sale actually existing.

LICHT finally turns to Java. Here the difficulties in effecting sales are on the increase; present prices are no doubt already pretty close to the low Java costs of production. But the quantity of sugar to be disposed of this year will scarcely be less than in preceding ones, so no alleviation of the world situation is to be looked for here.

Summarizing, LICHT deems that the near future looks by no means bright. It resolves itself into the question whether the industry is to submit itself to the process generally described as "the survival of the fittest"—a process lasting at best many years and causing severe losses even to the survivors—or whether new efforts shall be made to solve the sugar problem on an international basis. A necessary preliminary to this last is that the sugar countries must be properly organized, and LICHT observes that whilst so far international agreement has been frustated by the opposition or the doubts of the Java sugar industry, Cuba has now to be considered the hindrance, for there exists no organization whatever in her industry. As for Java, LICHT states that the latest well-informed opinion in that island is to the effect that the sugar industry there feels inclined on principle to entertain new international negotiations; but the Dutch are certainly not disposed to sacrifice themselves to the interests of the U.S.A. or to any other parties remaining outside the proposed agreements.

The Plight of the West Indies.

Since the Budget announcement, nothing has occurred to suggest that the Government have departed from their attitude of *non possumus* in regard to the desperate plight of the British West Indian sugar colonies. LORD PASSFIELD, the Colonial Secretary, has communicated officially with the governments of the colonies concerned, but has done no more than confirm previous statements and telegraphic dispatches explaining why it is impossible for his Government to accept the recommendations of Lord OLIVIER'S Commission. He emphasized that other industries were in the same unfortunate position of finding price below the average cost of production and that the Government could not stand the drain of meeting the liabilities of all these industries. On the other hand, he invited attention to the numerous subsidiary recommendations of the Commission, some of which he deemed of considerable importance, and he requested the colonies to consider and report on the feasibility of carrying them out. He finally offered them the cold comfort of assistance from the Colonial Development Fund to facilitate the substitution of other crops for sugar.

In other words, the Government refuse to assist the staple crop of our West Indian dependencies, because certain home industries amongst many are also in need of assistance. The remedies that 90 per cent. of the rest of the world would employ to assist similar needy parties of their own are ruled out by the political party in power in England because their intellectuals are still wedded to a doctrine which the less influential but more practical men of the party are increasingly disposed to question as being applicable to present day conditions. It is not necessary to uphold high protection in order to

disbelieve in one-sided free trade. There may be much to deplore in the extent to which certain countries bolster up their sugar industries for example, by means of excessive protection ; the League of Nations has decided opinions on this point. But it is increasingly clear that so long as one great importing country clings to free imports, so long will it be impossible for the rest of the world to be brought to compromise. This fact is being increasingly realized in Great Britain, and the day may not be distant when public opinion here may give a political party the power to close up the gap, and put this country in a position to bargain with other countries for lower tariffs, or to penalize them fiscally in the event of refusal.

The New Trend of Politics in England.

It is significant that two big groups of newspaper proprietors in England are carrying out a campaign of reform and are trying to " ginger up " politicians, the Conservative party chiefly, to adopt schemes of protection for home industries and/or a sort of Empire *Zollverein*. The two policies are not at the moment altogether reconcilable, as LORD ROTHERMERE, the protectionist, does not see eye to eye with LORD BEAVERBROOK, the Empire Free Trader. But both are agreed that the policy of free imports, inaccurately labelled " free trade," is one that will have to be abandoned, and that speedily, if this country is not in time to descend to the status of a second-rate commercial power. Popular newspapers do not usually go out of their way to boom a new economic doctrine unless they feel that the pulse of the public is favourable for the venture. They have too much at stake in their vast and competitive circulations to care to support an unpopular cause. It is also significant that the trade union group who are generally classed as the right wing of the Labour party—the free traders who largely form the governing section ranking roughly as the centre—are becoming increasingly dissatisfied with the existing system, and particularly with Mr. SNOWDEN's declared intent to take off at first opportunity the few protective duties that do exist — all because the doctrinaires disbelieve in them. It is clear to most observers that home politics are in a state of disintegration and sooner perhaps rather than later the old lines of demarcation will be obliterated—by the electorate if not by the political parties themselves. Mr. BALDWIN, as leader of the Conservatives, is now committed to a policy of liberal safeguarding of home industries, but he hesitates to countenance the taxing of foreign food in favour of Empire products without the endorsement of the public by means of an *ad hoc* poll, or referendum. Whether his caution is justified or not is probably one of the most debatable political problems with which the country is at the moment faced. But, unless an early general election is precipitated, the problem may solve itself in time through the better education of the electorate, and these last seem in process of conversion at a rate that must be alarming to the doctrinaires.

Cuban Disunion.

On another page our Cuban correspondent sets forth at some length the principal factors that in his judgment have led to the break-up of the attempt in Cuba to co-ordinate the selling side of the sugar industry. He writes as an American, long domiciled in the island, and his main conclusion is that the recent contretemps was engineered by American interests whose object was solely to get cheap sugar, and to whom the need for improving the economic position in Cuba was a secondary matter. The various attempts

made by the Cuban Government since 1925, first to restrict the crops, and then, when restriction was abandoned, to co-ordinate the sale of the sugar, were made primarily with a view to protecting the smaller sugar companies, mostly Cuban ; it has been these companies—the Latin mills as our correspondent terms them—that have reduced their output since 1925 in an attempt to adjust supply to demand, but their efforts have been useless because the North American interests controlling over 60 per cent. of the industry have mostly expanded plantings. Seven big groups, connected if we mistake not with the American refining interests, have increased production by no less than 17 per cent. ; other North American mills have registered decreases, but the net result as compared with 1924-25 is that the N.A. mills have increased production by 3 per cent., whereas the Latin mills show a decrease of 7 per cent. in their output. Our correspondent supplies an instructive table showing these figures in detail.

Since the war several of the American banks have taken over a large number of sugar mills and in some cases sold them to companies organized by them, and in others formed operating companies to manage them. These are the companies that have gone in most for expansion, and with their ample financial resources they are disinclined to curtail operations. Then, as our correspondent points out, the refiners, brokers and speculators are all interested in getting cheap sugar. As middlemen they are not concerned with the producer's difficulties of making a profit. " Low prices for Cuban raws are desired by U.S. refiners so that they may keep the price of refined down and make it difficult for the continental beet and cane producers to compete, . . . and so that a wider margin may be charged without an apparently high price for refined."

These, it would appear, are the hostile elements trading in Cuba who have defeated the attempt of the Cuban Government to ameliorate the lot of the smaller producer and also of the large number of colonos interested in the cultivation side of the industry. As we have already recorded, there was a woeful lack of co-operation amongst the sugar industrialists which was inimical to the success of the single seller ; but in view of the above mentioned facts, it would have been surprising if it had been otherwise. Unfortunately also, the Chambers of Commerce in the island adopted a hostile attitude, seemingly because they feared that co-operative selling might be followed by co-operative buying for the industry. But the missing cornerstone of the edifice of the Government programme of co-operation was the lack of financial support to see the scheme through. They were dependent on outside aid for this, that is on American banking aid, and though it would appear that the American banks gave the Cuban Government last summer the necessary verbal assurances, the money was not forthcoming when actually needed, so the edifice crashed.

It remains to be seen now whether the Cuban Government can try another line of advance in order to protect the smaller producers and the large number of cane growers ; or whether it will be forced to see Cuba become increasingly a cane-growing preserve for American interests who, it seems clear, will make no effort to adjust supply to demand, and in that respect threaten to be a menace to the world sugar industry as a whole. If Cuba is to remain an independent power she will have to work out her own salvation and protect her indigenous interests ; the solution, as our correspondent suggests, may conceivably take the form of diversifying the crops produced and relying less on sugar. But, meantime, it should not be beyond the wit of her Government

to try again to co-operate the more favourable elements in the sugar industry, including the *colonos*, some 30,000 in number, who contribute 90 per cent. of the cane crushed by the 180 mills. Unfortunately, the ethics of government in Cuba, from all reports, leave much to be desired, and an otherwise justifiable policy may suffer discredit from the mode of its application.

The British Sugar Beet Society.

At the annual meeting of the British Sugar Beet Society held in April, a satisfactory degree of steady progress was reported, though there is a complete cessation of the building of new sugar factories. Last year 54,000 acres more of beets were grown than in 1928, and this season a further increase of 88,000 acres is expected, no less than 320,000 acres having been contracted for. The tonnage on the average is not as satisfactory as had been hoped for, but as regards 1929 it may be partly accounted for by the drought which affected the light lands. On the other hand, the admitted failure of many of the newer growers to seek and follow the help and advice of the factory experts and the county agricultural organizers necessarily had a deterrent effect on the tonnage achieved, and so 8½ tons of beets per acre is the average of the whole production. The Mason Cup and Medal winners, however, came out well with tonnages in the neighbourhood of 20 tons roots and over 3 tons of sugar to the acre, figures which clearly show the scope for improvement available for the bulk of the growers, even allowing for the fact of varying soil fertility and productiveness.

One of the advantages to the farmer of growing this crop was pointed out by the chairman, Col. E. Royds, and that was the credit facilities offered by the factories. Thereby the grower can get some of the capital advanced him to grow his crop (something like £5 per acre in the course of the summer) and then has a guaranteed price for his roots in prospect. This is a financial feature which is surely if slowly impressing itself on the British farming community. It is true we have still to enter the final and lowest stage of the subsidy (coming into operation for the 1931 crop) and one hazards that the factory terms to the growers may not then be entirely to the liking of the latter. But the longer view seems more important, and the more the farming community in this country is attracted by the merits of sugar beet culture, both as a valuable rotation crop and as a means of securing quick returns for outlay, the less likely will be the prospect of the politicians leaving them wholly unsupported when 1934 comes round. The last few months have witnessed a striking revival in this country in the demand for the safeguarding of home industries, and if the campaign in its favour fulfils the present indications of growing support, the prospects of the home beet sugar industry obtaining security of tenure will be considerably enhanced. But more spadework remains yet to be done before the industry can be classed as really efficient.

At the above meeting Mr. Alfred Wood took the opportunity to correct the impression apparently widely held that the factories have hitherto been accustomed to discharge process and other waters into rivers without any treatment. Actually, when any factory was built, a purifying system was installed similar to that developed on the Continent, and Mr. Wood, speaking as a member of the Beet Sugar Factories Committee, said that, in all, the factories had to date spent some £341,000 on purifying plant, devoted to a real attempt to reach the highest standard of success possible in the light of present day knowledge. The cases of river pollution which cropped up last

season and led to legal proceedings were due, he explained, to the exceptional drought of last summer which made it impossible for the factories to do everything they could wish for the fishing interests and at the same time maintain those of nearly 70,000 workers. But they have been able to advise the Ministry of Agriculture and Fisheries of a substantial advance in the methods to be employed during the coming season.

Cane Variety Problems in South Africa.

On another page we give some extracts from an important paper, summarizing the results of the intensive campaign, conducted during the last half dozen years in Natal, to prepare the ground for replacing to some extent the North Indian variety, Uba, by more profitable types. This matter is not only of vital moment for the future of the South African sugar industry, but should be of great interest to all students of virus diseases among plants, because of the unique conditions prevailing in the Natal sugar belt. The cane universally grown in the fields has many drawbacks, but has one great asset, in that it is immune to mosaic, and highly resistant to most other cane diseases; and thus Natal is placed in a very favourable position as regards most other cane growing countries, as she can claim that she is not suffering from either pest or disease in the cane fields to any appreciable extent.

But the Uba cane has its own virus disease, called Streak from the pattern on its leaves, and this disease has been shown to attack at least 18 of the cane varieties recently introduced under quarantine regulations into the country for testing. While not apparently so devastating as cane mosaic (Uba is to a great degree tolerant of streak), we must be prepared for the appearance of this new virus disease in various countries, because of the wide distribution of Uba for breeding and other purposes during recent years--in fact reports are already being received of the occurrence of streak elsewhere than in Natal. Natal's campaign referred to above has been to clear out all cane varieties other than Uba from the country, as most of these have been found to harbour mosaic; and thus to create a mosaic-free cane tract for the growth of the newly introduced varieties. How far this has been successful, and the unexpected difficulties that have been met with, will be seen from the perusal of the extracts which we have made.

The Question of New Cane Varieties in Mauritius.

While on this subject, it may be mentioned that one of the matters relating to the sugar industry in Mauritius which was brought forward in Sir FRANCIS WATTS' Report recently published,[1] was the importance of meeting the incidence of disease in that island by introducing new varieties either immune or resistant to such diseases. Not quite so much as in South Africa is Mauritius dependent on one cane variety, but about 60 per cent. of the crop is composed of the White Tanna; and the Department of Agriculture is rightly apprehensive lest the consequences involved in depending so much on a single variety may loom large in the near future. Much work has indeed already been done by the Department in obtaining promising varieties from other countries, in investigating their value and suitability for Mauritius conditions, and in distributing them to planters. It should be noted that the Department is fully alive to the danger of introducing pests and diseases when canes are brought in from other countries; proper quarantine is provided for newly introduced canes, and Sir FRANCIS WATTS remarks that owing

[1] See *I.S.J.*, 1930, 180.

to the vigilance of the officers of the Department the presence of mosaic disease on certain imported canes has been recognized before they were distributed : these were destroyed and the Colony saved from the introduction of a dreaded disease.

To Dr. TEMPANY appears to have been chiefly due the credit of impressing on the Mauritius sugar industry the necessity to introduce new resistant varieties. His views at the time received a good deal of attention both from the planters and from the Government, in consequence of which the matter was submitted for the consideration and advice of the Imperial Bureau of Mycology at home. The outcome was that Mr. S. F. ASHBY of that Bureau, who has extensive first hand knowledge of cane disease, visited Mauritius to inquire into the incidence of diseases and to advise concerning them. He was able to confirm the work of Mr. E. F. S. SHEPHERD, the Island Botanist and Mycologist, who found that there were two distinct diseases likely to be confused under the name of "gumming disease," namely, the true gumming disease of Australia and the Australian Leaf Scald. It has been shown that White Tanna is susceptible of being affected by both diseases to the same extent, while leaf scald is widespread over the island and the losses caused by it are greater than those occasioned by gummosis.

At the same time Mr. ASHBY while recognizing the presence of certain diseases which, if neglected, may be capable of doing much harm, does not apparently suggest that the industry so far is experiencing any grave losses from these, and appears to think that the planter with the assistance of the Department of Agriculture can handle the situation without resorting to any violent or disruptive measures. This is just as well, since with the extensive ratooning practised in Mauritius, the fields are only re-planted at intervals of from seven to eight years or more, so that in the ordinary course it would take a long time to supersede the existing cane plants with new varieties. The introduction of newer resistant types can therefore be undertaken with ample time to study their characteristics in their new environment.

MANCHESTER DISCARDS FREE TRADE.—The Manchester Chamber of Commerce lately took a referendum of its members with regard to their fiscal policy, and the results were somewhat surprising, as on a 58 per cent. vote of the traders of that Mecca of free trade, there was approximately a three-to-one majority in favour of fiscal reform. In favour of the policy " generally known as free trade " there were 607 votes or less than one-sixth of the whole membership of nearly 4000 ; " in favour of a settled policy of imposing protective duties in the manner generally known as safeguarding " there were 986 votes. Other votes were cast for varying forms of protection ; in the aggregate 607 votes were cast for free trade and 1736 against.

RESEARCH PAYS.—" The total budget of the Research Bureau of the Philippine Sugar Association for last year was ₱75,000.[1] We have calculated the actual value of a few of the findings of the Research Bureau ; to be conservative, we have usually divided calculated savings by two. The results are surprising, even to ourselves. For example, the finding and demonstration that phosphoric acid gave large increased yields in the estimated 35,000 hectares of uplands of western Negros alone, gives increased yields annually valued at more than $180,000 . . . It is, more difficult to evaluate the increased yields from variety experiments. In addition, however, to all the tangible financial returns is an even greater quantity of intangible savings resulting from the growing of more ratoons, longer cropping, fertilizing at time of planting, avoidance of diseases, and so on, almost indefinitely, which mean that on our investment of pesos in research annually we are obtaining an annual return of well over 4000 per cent."

1 ATHERTON LEE in his Director's Report to the Philippine Sugar Association.

Some Controlling Factors in the Cuban Sugar Industry.

By EARL L. SYMES.

Little consideration has been given to the factors which brought about the downfall of the Co-operative Sugar Export Agency (C.E.A.) in Cuba. Some idea of the difficulties with which it was contending and the partial results of its operation was given in our April article, which mentioned the rabid agitation and newspaper propaganda then prevailing. This achieved its object when on April 14th, the C.E.A. was dissolved, liberating more than three million tons of sugar and causing the price to fall below the lowest point on record. A study of the reasons for this abrupt change will be of interest, in view of the magnitude of the task undertaken.

As indicated in the September issue (p. 459), this organization was not a real co-operative, being one in name only. The fundamental idea of a real co-operative is *one man, one vote*, and in the C.E.A. there were men with three thousand votes and others with only a hundred, according to the production and shares held by their respective mills. Substantial equality among producers interested in a co-operative with respect to its affairs is fundamental, as well as similarity in aims and objectives. It will be shown that there is no such singleness of purpose among the various producers of Cuban sugar, and for this reason it is impossible to form a co-operative which will handle the entire crop, even when it is attempted by governmental decree.

Considering the steady growth of the agricultural co-operative movement in other countries, there is a possibility that this method of doing business may succeed in Cuba when proper preparations are made. The co-operative movement began in England, in 1844, at Rochdale ; and Manchester is considered the world centre of co-operation. It was adopted in France in 1848 and there are now co-operative reserve banks there.

A co-operative cheese factory was started in New York State in 1851 ; co-operative banking dates from 1852 in Germany ; co-operation is one of the few carry-overs from the old regime in Soviet Russia. The persistence of this method of doing business through the past eighty years and its spread to many countries and its growth to large dimensions in spite of the continued opposition of avaricious commercial groups, are strong indications of the soundness of the agricultural co-operative. It seems to find its most favourable environment where the leading business men have come up from the land. This may account for the absence of co-operatives in Cuba, where the leaders in business as well as politics have, with few exceptions, never been ordinary farmers nor handled a plough. They seemed to realize that if the C.E.A. were successful, it might lead to real co-operation in buying as well as in selling, and due to their efforts many Chambers of Commerce throughout the Island joined in the fight against the C.E.A.

Real co-operation among producers of Cuban sugars shipping through one port should prove successful if such a group could be formed voluntarily, and if they could reach an agreement with a single refinery to supply its entire requirements. Before this can be done, however, some method of providing agricultural credit other than through commercial banks must be provided, and the same group of producers might be able to form a co-operative bank with necessary governmental assistance and legislation. It should be remembered that the real cause of the downfall of the C.E.A. was the inability to secure credit on stored sugars from the existing commercial banks. Co-operatives in the United States had the same difficulties until 1916, when the Federal Farm Loan Board was created, and in 1923 the Federal Inter-

mediate Credit Banks were formed to discount warehouse receipts for the co-operatives. These financial institutions have solved the seasonal crop credit problems at a comparatively low rate of interest.

Financing of warehoused sugar has been done in Cuba by the commercial banks for years, and it is understood that before the formation of the C.E.A. last July the government received assurances from the Havana bankers that some method could be worked out to finance the C.E.A.'s holdings of sugar. These assurances proved to be but an empty gesture, a kowtowing to officialdom. At the final showdown in April the members of the Havana clearing house advised that they had been instructed by the U.S. Federal Reserve Board not to lend money to the C.E.A. or finance its sugar holdings in warehouse. On the one hand, we have the Federal Farm Board lending money to Agricultural Co-operatives in the United States, and financing commodity price stabilizing corporations with money from its half billion fund; and on the other, we find the Federal Reserve Board refusing funds to the Cuban co-operative which was organized to regulate sales and stabilize the price of sugar. Another inconsistency is the success of Brazil in floating a large loan to finance its coffee. This must have had the consent of the U.S. financial authorities. The U.S. Chamber of Commerce has just passed a resolution condemning the Farm Board for lending money to co-operatives at lower rates of interest than obtainable in commercial banks. These citations indicate the obstinate opposition of commercial and banking groups to the co-operative movement, and show that special legislation is necessary to provide the credit required by such organizations.

The U.S. refiners, sugar brokers and speculators formed another important factor in the destruction of the C.E.A. They provided a hostile and continuous propaganda from the North composed of misleading rumours and disquieting reports, and it is not improbable that they were at the back of the Havana newspaper campaign that did so much to help build up the opposition.

The refiners did not like the attempt of the C.E.A. to secure part of the 44-cent preferential allowed Cuba in the U.S. Tariff, by quoting them a price 30 to 40 points higher than that prevailing in the world market. They confined their purchases to duty frees and took very litle new crop Cubas at the Agency's set up price. When they had practically exhausted the old crop Cubas stored in the United States and the supply of duty frees was becoming skimpy, they became desperate. It is reported that they appealed to the Federal Reserve Board not to allow any financing for the C.E.A. to go through, on the charge that the C.E.A. was a monopoly holding up the price of Cuban sugar in restraint of trade. This brought the desired result and the C.E.A. was dissolved, allowing the refiners and speculators to buy Cuban sugar at the lowest price in history. The Capper-Volstead Act of 1922 allows co-operatives to fix prices for their products so long as such prices are not unduly enhanced. No one could prove that any price asked by the C.E.A. was "unduly enhanced," since such a figure would mean an undue profit over the cost of production, and a phenomenon of this nature has not been recorded for several years in the sugar business. To claim that a co-operative is a monopoly is old-fashioned, since the Clayton Act of 1914 provided that agricultural co-operatives should not be held to the Sherman Anti-trust Law. There is no act immunizing the refiners, however, from this law, and the courts regard the fixing of prices or agreement on a schedule of prices by a group of manufacturers of the same product as a violation of the anti-trust laws. WILLETT

Distribution of Cuban Sugar Production.

Spanish Tons of 2240 Libras.

Name of Producing Group.	Crop 1918-19 Mills.	Crop 1918-19 Tons.	Crop 1924-25 Mills.	Crop 1924-25 Tons.	Crop 1928-29 Mills.	Crop 1928-29 Tons.	Increase in Production over Crop of 1918-19: 1924-25	Per Cent.	1928-29	Per Cent.	Increase in 1928-29 over crop of 1924-25. Tons.	Per Cent.	1929 Total Crop Per Cent.
General Sugar Co. (N.C.B.)	7	98,673	8	262,691	8	298,700	164,018	166	200,027	203	36,009	14	
Punta Alegre Sugar Co.	7	182,944	7	334,680	7	400,420	151,738	83	217,476	119	65,740	19	
Cuban Dominican Sugar Co.	6	131,010	8	223,646	8	246,121	92,636	71	115,111	88	22,475	10	
Cuban American Sugar Co.	6	279,567	6	303,868	6	317,643	24,301	9	38,076	14	13,775	5	
United Fruit Co. (Refin., U.S.)	2	112,246	2	158,450	2	261,316	46,204	41	149,070	133	102,866	65	
American Sugar Refining Co.	1	69,721	2	173,774	2	195,362	104,053	149	125,641	180	21,588	12	
Cuba Company	2	84,856	2	118,921	2	125,572	34,065	40	40,716	48	6,651	6	
Total Groups continuously expanding production	31	959,017	35	1,576,030	35	1,845,134	617,013	64	886,117	92	269,104	17	
											Decreases from 1924-25.		
Cuba Cane Sugar Co.	14	536,367	14	646,751	13	575,320	110,384	21	38,953	7	71,431	11	
Cuban Trading Co.	5	208,753	5	276,770	5	254,281	68,017	33	45,528	22	22,489	8	
Sugar Plantations Op.Co.(RB)	8	121,206	10	189,876	8	145,495	68,670	57	24,289	20	44,381	23	
Hershey Cuban Refinery	5	89,474	5	131,650	3	116,965	42,176	47	27,491	31	14,685	11	
Total Groups with decreasing production after 1924-25	32	955,800	34	1,245,047	29	1,092,061	289,247	30	136,261	14	152,986	12	
											Increase	Net	
Total Large North American Groups	63	1,914,817	69	2,821.077	64	2.937,195	906,260	47	1,022,378	53	116,118	4	
Other North American Mills	18	393,860	19	563,670	19	546,425	169,810	43	152,565	39	—17,245	—3	
Total N.A. Groups	81	2,308,677	88	3,384,747	83	3,483,620	1,076,070	46·6	1,174,943	51	98,873	3	67·6
Total Latin Mills	117	1,701,057	95	1.804,599	80	1,672.658	103,542	6	—28,399	—2	—131,941	—7	32·4
Total for Cuba	198	4,009,734	183	5,189,346	163	5,156,278	1,179,612	29·4	1,146,544	28·6	—33,068	—0·6	100·0

Some of the mills listed as belonging in the North American Groups in 1919 were actually at that time under Cuban control, but were later taken over and their production maintained or increased by the N.A. interests.

N.C.B. = National City Bank. R.B. = Royal Bank of Canada.

& GRAY's daily publications show that every refiner in the United States changes his price of refined up or down in accordance with a similar change made by the other refiners, and they all invariably quote the same price and try to make their changes effective at the same hour. The regulation of sales by co-operatives is not considered restraint of trade by the courts. Did the C.E.A. receive fair treatment from the refiners ?

There is nothing economically sound in producing crops that must sell at a price below the cost of production. When such a condition arises ordinarily, industries close down certain producing units and limit their expenditures for raw materials; that is, they try to bring their portion of the supply nearer to the demand so that a price higher than the cost may be obtained. The North American interests controlling over 60 per cent. of the Cuban sugar industry have not followed this practice, but on the contrary have kept producing units open, and expanded plantings, and absorbed tremendous losses in the past few years. Many mills have shown steady losses of more than $200,000 yearly during the past five years, yet they are kept going by individual banking interests, apparently competing with one another to see how long they can continue to take losses. Two large North American companies have crashed in the past year with a total loss to stock-holders, in the re-organization, of more than $100,000,000. The bond-holders took the assets created by the shareholders' money and the latter were only offered the opportunity to subscribe for more stock in the new companies. Is this the object of the bond-holding banks in their Cuban operations ?

A table has been prepared showing the production of the North American interests as well as that of the others in the Cuban crops of 1918-19, 1924-25, and 1928-29. In their efforts to have the supply meet the demand the seven groups with 31 mills in 1919 increased their production by 64 per cent. for the crop of 1925 and then had 35 mills. With the same mills in 1929 their production had almost doubled that of 1919 with an increase of 92 per cent. The price was below 3 cents from 1924 on, yet this group expanded 14 per cent. from the 1925 crop to that of 1929, showing a queer conception of making the supply fit the demand. The price since 1924 has been near to, or below the declining costs, yet the signal to reduce supply was unheeded, and a strong contribution made to the present situation by these interests.

It will be noted that the Latin mills have fallen off since 1925, and now produce only 32·4 per cent. of the total, as compared with 42·4 per cent. in 1919. The tendency among the larger producers as shown in the first group of 31 mills has been to increase production, and this tendency is still alive, as may be seen from the following resolution presented at the April 14th meeting of the C.E.A. by the representative in Cuba of the American Sugar Refining Co. It is first requested that the C.E.A. be dissolved with the return of 80 per cent. of the sugars under its control to the producers. Then the motion reads : In order to interest the U.S. and British refiners, brokers and speculators, who have been withdrawn and indifferent since the formation of the C.E.A., let the widest possible publicity be given to the *fact* that the native and foreign mill owners of Cuba adopt the following resolutions : --

(*A*) That no new restriction of crops will be declared.
(*B*) That no " beginning date " shall be set for any future crop.
(*C*) That no single seller shall be set up.
(*D*) That no new plan of unified sales shall be tried.
(*E*) That the export of sugar will not be organized, limited nor taxed in any way.

(*F*) That the planting of cane shall not be prohibited nor limited in any form.
(*G*) That the cutting of forests shall not be prohibited especially for cane planting.
(*H*) That no attempt shall be made to force the law of supply and demand.
(*I*) That no other measures which may prevent Cuba from making the greatest number of tons of sugar at the lowest possible price shall be adopted. To promote Cuban competition in world markets under the most favourable conditions efforts will be made to annul the Tarafa Port Law which prevents the use of private shipping ports, and also to reduce freight rates in Cuba, which are to-day the highest in the world.

This is rather a complete declaration of intent and purpose and, while it was not adopted in its entirety, it serves to indicate what the powerful interests in control of two-thirds of the Cuban sugar industry want to accomplish. There is no intention to reduce plantings in an effort to bring the production down near the demand. The refiner's spokesman in the U.S., upon hearing of the dissolution of the C.E.A., stated to the press that the sugar industry should abide by the law of supply and demand, and yet the actions of the North American groups in the past have been in violation of that law and their plans for the future in Cuba as revealed in the above resolution are not in accordance with it either.

The same negligence of this law is noted in the refining capacity existing in the United States, where a yearly melt of 7,700,000 tons of raws can be handled and there is demand for about 4,500,000 tons ; i.e., the supply is 70 per cent. greater than the demand. The depreciation and interest on this large excess refining capacity is one reason for the wide margin charged, which in its turn requires that the price of refined be unduly enhanced. The refiners' annual reports all show substantial earnings in sharp contrast to the losses of Cuban raw producers, as will be observed in the following comparison taken from the April *Economic Review* of the National City Bank.

No. of Companies	Operations in		
		NET WORTH.	
		January 1st, 1928.	January 1st, 1929.
18	Cuba	$315,615,000	$300,193,000
33	U.S. and Insular	$394,889,000	$407,731,000
		NET PROFITS.	
		Loss 1928.	Loss 1929.
18	Cuba	$2,897,000	$3,195,000
		PROFITS.	
33	U.S. and Insular	$36,441,000	$25,979,000

Low prices for Cuban raws are desired by U.S. refiners so that they may keep the price of refined down and make it difficult for the continental beet and cane producers to compete, so that less capital may be needed to buy raws, and so that a wider margin may be charged without an apparently high price for refined. The bankers may like a low price for Cubas, so that they can foreclose on more mortgages and control a larger portion of the sugar producing properties. These are the interests now in control of 67 per cent. of the Cuban production and their actions referred to above do not indicate that they desire any improvement in conditions in Cuba, and they apparently get what they want. All efforts of the government to combat this element and aid the small producers have been made ineffective by the stronger counter interests. About the only solution left to the government is to adopt discriminatory legislation and taxation and aid the native producers to produce diversified crops by protective tariffs. This will raise the cost of living, but the buying power of the Cuban people will be raised by the better remuneration that may be derived from other crops.

South African Sugar Notes.

(By our Durban Correspondent.)

The Existing Situation.—Sugar prices during the 1929 season were at a very low ebb for two main reasons. Firstly, a record export quota sold at an unusually low world's price ; and, secondly, a quantity of sugar was dumped into the country and severely depressed the home market. Dumping duties were imposed, but could not be made effective against Holland and Cuba in terms of the Customs Act. In view of the above facts the planting and milling industries made very strong representations to the Government for some further measure of protection. The planters in addition advanced the suggestion that consideration should be given to the practicability of imposing some sort of check on the rapid expansion of planting areas, which was causing an ever increasing proportion of the production to be exported overseas at a price far below the cost of production. Owing to the fact that Parliament was not in session, and that after re-assembling there was a considerable amount of other business to be attended to, it was not until late in March that anything could be done. It was then that the Minister of Finance announced that the import duty on sugar would be raised from £8 to £12. 10s. 0d. per ton, the duty to come into effect immediately. In spite of the opposition of interested factions and theoretical free-traders, the Budget containing this provision has now been passed.

This duty should prove an effective barrier against the entrance of all outside sugar, except a certain amount from Mozambique which, besides being produced with exceptionally low labour costs, also enjoys preferential rates on the South African Railways.

One of the conditions under which the suspended portion of the 1926 duty was imposed was an obligation to provide sugar to manufacturers at duty-free rates. The cost of this is borne equally by all millers and planters who are signatory to the Fahey Conference Agreement. Certain milling companies, however, are not bound by this Agreement and certain planters who have not assented to the Fahey Agreement are at the moment claiming payment for cane based on the price of refined sugar not subject to this rebate or to export. These exceptions naturally increase the burden for the conforming section of the industry.

New Sugar Bill.—To meet these and other circumstances, a Bill has just been drafted and will be submitted to Parliament in due course : it comprises provisions

(1) To apply the provisions of the Fahey Agreement to all millers and planters.

(2) To establish a permanent Board of Arbitration to settle disputes arising from the interpretation of the Agreement.

(3) To provide for the sanction of the above Board to the cultivation of new cane growing areas.

The first two provisions are almost universally welcomed. The third, however, is highly controversial and is expected to receive a certain measure of opposition. With few exceptions the millers are opposed to any limitation. This is only to be expected, as an increase of cane crushed would materially reduce manufacturing costs. On the other hand, the extension of cane growing areas would be of no assistance to planters in the present areas. There is also the very large body of public opinion which, not being directly interested in the industry, looks with disfavour on any measure which would adversely affect the country's export trade.

While the new rate of duty should have a good stabilizing influence. it would be idle to look for any sharp rise in prices. The price for the past season for 13 per cent. sucrose cane will be in the neighbourhood of 14s. 4d. For the coming year this should be in the neighbourhood of 14s. 9d. As the price basis of cost of producing a ton of cane was fixed by the Board of Trade in 1926 at 15s. 6d., it will be seen that the position will still be difficult unless there is a material improvement in the world's markets.

The Prospects for the Season.— Owing to extended plantings another record crop is expected, probably in the neighbourhood of 320,000 tons. This will be the fifth year in succession to show an increase. The past few months have been unusually dry and the cane in some parts is showing the effects of drought. As there are now only a few weeks before the dry winter starts, it is to be hoped that there will be some saving rain. Unless unduly damaged by drought, the cane for this season is expected to be of higher sucrose content than last year. The total crushing capacity of the industry remains about the same. One small factory will not crush, but another small one is expected to operate for the first time. Two factories have somewhat increased their capacity by additions to their milling plants. In order to cope with the increased crop, an early start all round has become necessary, and most factories will be starting during the first half of May.

The Length of the Season.- This brings us to the difficult question of confining the crushing season within reasonable bounds. The peak month for sucrose is September. From June to the beginning of December the cane is of fairly good quality. Limited capacity, however, has compelled the extension of crushing operations beyond these limits, so that a considerable quantity of cane has to be crushed in May before it is mature, and in late December and sometimes January after it has begun to fall off. In particular, a late close, such as was experienced last season, proves very injurious, and considerable quantities of cane were rejected in January. Last year's operations were considerably delayed by malaria, and this again threatens to become a serious factor in some districts. The late closing also interferes with planting operations.

For some time past the steady growth of capacity of individual factories has been accompanied by the elimination of the smaller units. In recent years a number of very small units have been erected in outlying areas, but this is not likely to continue. On the other hand, there is little opportunity for any new large factories in the present areas, as most planters are bound by long term agreements to the existing factories. To cope with the ever increasing tonnage and to keep the season confined to the best months, it will therefore be necessary (1) to have new large factories in new areas if these are not restricted ; and (2) considerably to increase the capacity of existing factories.

One such new factory is at present being mooted. More than one factory has already planned considerable extensions, but a great deal will have to be done if there is not to be a serious overtaxing of existing plant, and a dangerous extension of the crushing season in the near future.

Durban, May 8th, 1930.

LOW PRICE LEVELS FOR VARIOUS COMMODITIES.— **Other world products are experiencing with sugar the evils of over-production and uneconomic prices. Rubber has reached the new low record of 6¼d. per lb. ; tin has fallen to the lowest price for 20 years ; silver has dropped as low as 17$\frac{5}{16}$d. per ounce (which compares with 89½d. in 1920) ; while copper, long maintained at 18 cents per lb., has recently lost a third of its price.**

Cane Farming.

By C. A. BARBER, C.I.E., Sc.D.

The study last month of the Annual Report of the Bureau of Experiment ,tions in Queensland, where plantation and factory are under different ,anagement, and a great forward move is being made at improving the ,aracter of the field work, has suggested that it may be interesting to stitute a few comparisions between the position of cane farming in different ountries, and the possibility of bringing the results of research to bear upon it. But it will soon be seen that no generalizations can be indulged in from the excellent start that has been made in Queensland, for, as so often is the case in the cane sugar industry, we have there a set of conditions which is quite unique. Perhaps the most striking among these is that the industry in Queensland is to a large extent removed from the disastrous position at present met with in most sugar producing countries, because it is more or less independent of the world's price of sugar. With an assured local market at a comparatively high price for most of the sugar produced, there is no let or hindrance to her developing her industry in her own way. There is, moreover, no low priced alien labour to consider, and the price paid for sugar within the Commonwealth is regulated to meet the needs of her costly white cultivators. Queensland is thus placed outside the range of the economic factors dominating the rest of the cane farming countries.

It is generally held that, for cheap sugar production, unified control in field and factory is an advantage. And yet it is arguable that, because the operations in the two sections are so unlike, and require such different training and capabilities, a division of labour would furnish the ideal, and that they should be under separate control. But in that case a very complete co-ordination would be necessary, and that is apparently very difficult to obtain. And it may also be advanced that the great success obtained under unified control in Java, Hawaii, and Peru, with their special conditions, may have had an undue influence in forming the general opinion. After all, the form which the management assumes is only one of many factors bringing success to the industry ; and, leaving out the fundamental ones of climate and soil suited to growing good crops of cane, and the absence of avoidable losses in extracting the sugar and rendering it fit for the market, hardly any factor can be considered as vital.

Taking the most important, cost of production, it is an open question whether sugar can be more cheaply produced in Java, Peru or Cuba. The two first offer good examples of unified control, the last of the extreme of separation. As to cane varieties, Java has the best in the world, Cuba depends on Cristalina which is certainly capable of improvement, while Peru persists in planting the much abused Otaheite : Peru and Java are dependent on irrigation, which is practically absent in Cuba : in Cuba and Peru implemental cultivation is highly developed while there is very little but manual labour in Java, this difference being of course connected with the cost and amount of labour available : wages in Cuba are six times as high as in Java, and Peru is about half way between : long ratooning is characteristic of Cuba and Peru while it is altogether absent in Java: the trash is carefully returned to the soil in Cuba, it is as carefully cleared and burnt in Peru, while there is, of course, none in Java : finally, every stage of plantation work is guided by intensive research in Java, but there is little if any in the two other countries. Each country has its difficulties and its advantages. Perhaps the chief assets in Java are its cheap and abundant labour, its excellent cane varieties, and the complete organization, including an impressive research department, through which it has

been able to overcome its disadvantages. Peru has a mild climate for a desert, has an easily worked fertile soil and the cheapest irrigation water in the world; the estates are large and are said to be excellently managed, and there is very little if any disease in the fields. Cuba has many advantages in soil and climate, and till recently a superabundance of land; and it is quite possible that its colono system may be added as an asset, because it appears to be eminently suited to the genius of the people.

We thus get back to cane farming, and it will be well, in the first instance, to attempt some classification, based on the character of the farmers and the size of the individual holdings. On the whole there seems to be a tendency for the factory managements to encourage it, for they must have cane, and it appears to be gradually increasing. It is proposed to recount the chief facts at present known as to the status of cane farming in Cuba, Queensland and Mauritius, as representing the three chief types, although there are others.

It is stated that there are round about 30,000 colonos in Cuba, who contribute 90 per cent. of the canes crushed by the 180 mills. The holdings are very large, the average being given as 1330 acres; a colono having only 600 acres would be regarded as a small one, while some of them farm up to 10,000 acres. These men are substantial, and some of them wealthy and have great political influence. The cultivation leaves much to be desired, but it is only by economic pressure that any improvements are likely to be effected. Such is being exercised at the present moment. The present crisis in the sugar industry hits them hard, for the contracts with the mills are usually drawn up for ten years—5 to 6 lbs. of sugar for every 100 lbs. cane delivered to the mill. Many of these contracts were drawn up when the price of sugar was high, and now that it is low the money they receive is insufficient to pay for the cost of producing the canes. and some sliding scale will obviously have to be adopted. Another adverse factor for the colonos is that the custom hitherto prevailing, of working the soil out and then taking up fresh land, is becoming more and more difficult; there is not much land left within easy reach of the railway and the Government is disinclined to allow new forest land to be opened.

If and when the cane growers of Cuba desire to introduce the results of research into their fields, there is help at hand. The island has long had an agricultural department; and, during recent years there has been a great development of economic and scientific research on the plantations, the latter largely conducted by United States institutions. The weak point of this development appears to be in applying the results obtained to the fields. And, considering the present economic condition of the tropical sugar industry, it is permissible to hope that this application may be yet further delayed. A Cuba producing sugar to the limits of its capacity (as Java and Hawaii appear to be doing) would be regarded in other sugar producing countries and the sugar industry at large as a serious portent.

The conditions are quite different in Queensland. There are slightly over 7000 farmers supplying 38 factories with canes. The average holding is given as 40 acres, and it gradually increases from south to north in the long drawn out cane belt. In the older, southern portion the average acreage ranges from 30, where frost is somewhat severe and the rainfall often deficient, to 40 where the elements are less adverse to the growth of sugar cane. In the more recently developed northern section, where the rainfall is, if anything, in excess and the climate tropical, the average farm is about 50 acres in extent. Coupled with this there is a creeping movement of the focus of the industry towards the

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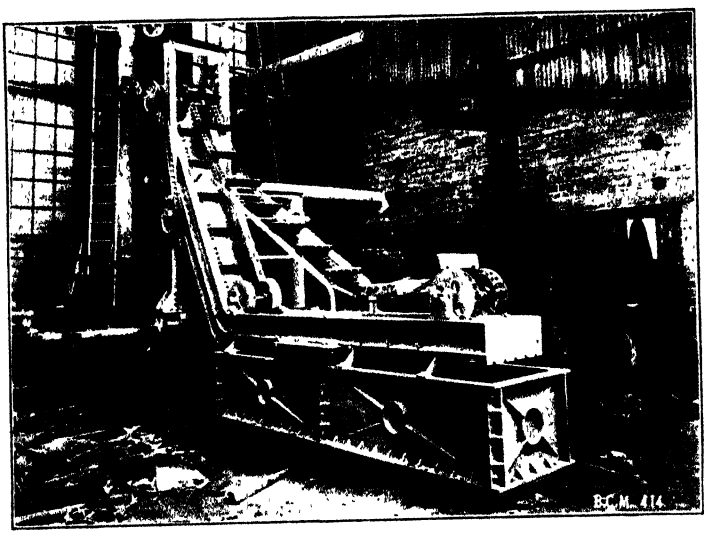

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north, in spite of the unsuitability of the climate to white settlers. The cane farmers are, as contrasted with the Cubans, themselves workers in the fields; and often the size of their farms is such as to avoid as much as possible hiring outside labour. There will of course be a certain number of wandering people plying for hire on the plantations, but this is only a marked feature, we gather, in the harvesting of the cane. While this latter work must be extremely arduous, it is very well paid and of course only lasts for part of the year. There is no particular hardship in any section of the industry, for the whole of it is under strict control for the benefit of the workers, who have abundant opportunities provided for the immediate relief from any well founded grievance. Furthermore, the wages are under strict Government supervision and liable to alteration from time to time as changing conditions appear to justify this.

But, in the nature of the case, most of these cane farmers when settling upon the land were new to the work and had to learn their business. This was early recognized and an agricultural department was founded some thirty years ago, with an experiment station in each geographical division to study fundamental problems, coupled with an energetic propaganda, by means of visits, meetings, bulletins, reports and even monthly typed circulars. But the opening up of new, rich land, as in Cuba, proved a bad school for training in agriculture, and it is to be feared that much of the excellent advice by the departmental officers missed its mark. The industry has expanded rapidly, especially of late years, and has produced an excess of sugar over the requirements of the Commonwealth, and this excess having to be sold on an unprotected market has brought down the profits among the cane farmers, no doubt acting as a salutary stimulus to better cultivation. At any rate the lesson has been learnt that the time has come for the industry to put its house in order. The experience gained through a quarter of a century has clearly indicated the lines on which further work should proceed. The isolated experiment stations clearly do not meet the need; and it is encouraging to note that the farmers have everywhere welcomed the call to conduct the experiments themselves, by which they can produce sugar more cheaply. Adequate preparations have been made for this forward move during the past four years by the proper training of the increased staff, both at home in the university and on the farms, and abroad by lengthy courses of instruction at the chief centres of sugar research. This staff has now completed its training and has entered upon its work of "missionary effort" with the most hopeful enthusiasm.

When we turn to Mauritius and certain of the British West Indies, the whole question of the improvement of the cultivation of the cane farmers is found to be on an entirely different plane. This term is not applied locally to the plantations which send their canes to a central factory, as in Trinidad, St. Kitts and Antigua; for, although this case is analogous to that in Cuba, the level of cultivation practice has always been much higher, and the planters are well able to look after themselves, and utilize such help as the local agricultural departments are able to afford them as the results of experiment. Speaking broadly, cane farming is a heritage of the former practice of the importation of East Indians to work in the cane fields; some of them having settled and obtained pieces of land on which they are growing sugar cane. The exhaustive Reports just issued pay marked attention to these settlers in Mauritius and the British West Indies.

With regard to Mauritius, we read that much land has passed into the hands of East Indians during recent years. The proportion of the sugar cane

land thus farmed in the island was 43·1 per cent. in 1928, while in 1922 it was 46·2 (this fall in the percentage may be attributed directly to the fall in the price of sugar, in that the smaller settlers found that they could not support themselves by growing cane at the lower price ; they therefore reverted to their former work on the plantations, incidentally relieving the industry from one of its periodic crises owing to shortage of labour). The yields of the cane farmers are low : with 43·1 per cent. of the land occupied by them, they only produced 25 per cent. of the sugar made in the island. Sir FRANCIS WATTS further points out that this is partly explained by the fact that the owners of the plantations have without doubt sold to the cane farmers the poorer portions of their estates. But, while some of the East Indians are men of substance, and follow current plantation work with close attention, the greater number have small holdings, with poor cultivation and small yields. These small settlers have no capital, cultivate the land by the co-operation of the various members of their families and live on the proceeds of the sugar cane, food crops, tobacco, etc., which they grow. Some of them manufacture farm yard manure according to the local method, but are under a strong temptation to sell this when made; others even purchase artificials. But there are all stages between the larger men with 15-20 tons of cane per acre and small ones which produce only 7 tons.

The proposals made in the Report for improving this state of affairs are well worthy of careful consideration. "The best methods of improving the status of the small cultivator would appear to lie in the application of steady, well-considered advice brought to him by means of instructors familiar with his modes of thought and outlook and speaking his language." A few demonstration plots should be founded in different parts of the island illustrating the results of good methods of working small holdings ; and these plots could serve as centres for regular meetings, where the best varieties could be exhibited and methods for controlling current cane pests and diseases could be discussed. Such meetings would also serve "for guidance in respect of the financial aspect of the work, explaining how the money coming in from the crop may be utilized and how this may be supplemented by means of money obtainable through such agencies as Agricultural Banks and Agricultural Credit Societies. . . . . With care, patience, and sympathetic knowledge it would seem possible to build up an important division of the Department of Agriculture devoted to the affairs of the small cultivators, a matter well worth considering when it is remembered that they occupy 43 per cent. of the area cultivated in canes in addition to other land."

The need for studying the point of view of the East Indian and of presenting the results of experiments in such a manner as to arrest his attention is fully appreciated by the writer of this article, as may be illustrated by the following episodes. After two or three years' work on an experimental station in a part of Madras where a serious cane disease was decimating the crop, a few resistant varieties had been isolated and it was desired to distribute one of them throughout the district, *on payment* so as to ensure their proper trial. But although these varieties soon appeared spontaneously in the neighbouring fields, absolutely no response was made to the advertisement of the resistant canes which was widely distributed. All the customary machinery of the district officials was requisitioned, but there was not a single application. A new line was then taken : the matter was urgent for the time for planting was passing. So an assistant was directed to load up a bullock bandy with the new canes and travel at night into the heart of the affected country ; unload them in the evening as the cultivators collected under the village tree, and

present each cultivator with one cane only, speaking of its virtues, and saying that more could be had at the experimental farm (of which most of them had never heard), *on payment*; then to proceed to a further night's journey, and so on till his stock was exhausted, when a fresh one would be forwarded to him. The next day 19 (the exact number has unfortunately escaped me) men from this village arrived with their bandies at the farm, having travelled all night, and with their money in their hands. A short time afterwards it was possible at the station to select among the applicants and only sell a certain quantity to each centre; very few of those canes were made into jaggery, the bulk being sold in the villages as seed cane at a high price. And, in two or three years the disease resistant canes occupied practically the whole district, and the local industry was saved.

Several lessons may be learnt from this. The improvement must be obvious to a good cultivator : he must pay at least the current price for anything he gets; otherwise he does not value it, and considers that he is doing a favour to utilize it : his attention must be arrested. It is not realized by westerns that the East Indian is often engrossed in his own thoughts and really does not take in what they are doing and saying, although to all appearance his close attention is given. I was riding a bicycle down the centre of a road on which a man was walking towards me. His eyes were fixed on me but he did not alter his course, and I suspected that he did not see me. I slowed down as he got near, stopping my machine as he walked into it. His alarm was intense, till I reassured him by my smile.

It is not easy to influence such people with the simplest western logic. And the work of any officer detailed for the improvement of their cane cultivation will probably be met with all sorts of unexpected difficulties. The surest way to overcome these will undoubtedly be to employ such officers as have the tact and patience to acquire an intimate knowledge of their environment and way of looking at things—down to an understanding of the details of their village life.

C. A. B.

The 1929 Java Sugar Crop.

By R. J. PRINSEN GEERLIGS.

During 1929, 179 factories were active in Java. The sugar estates planted and harvested an area of 197,085 hectares (486,799 acres) against 195,086 hectares (481,863 acres) in 1928. The total amount of cane harvested was 24,140,899 tons[1] or 49·59 tons to the acre. The total sugar crop amounted to 2,858,054 tons or 13,205 lbs. to the acre. The figures for the different Residencies and totals and averages in tons, lbs., acres, etc., as given below are calculated after the statistics compiled by Messrs. GYSELMAN & STEUP, of Soerabaja.

The 1929 season was not so good as that of the year before : it had an average production of sugar to the acre of 13,205 lbs. against 13,433 lbs. in 1928. The monthly estimates of the production of the mills associated with the United Java Sugar Producers were as follows :

Date.	Estimate. Tons.	Date.	Estimate. Tons.
25th March	2,712,000	1st August	2,645,000
1st May	2,715,000	1st September	2,634,000
1st June............	2,711,000	1st October	2,631,000
1st July	2,685,000	Final result	2,634,000

[1] Tons of 2,240 lbs.

In 1929 the average tonnage of cane amounted to 49·59 tons to the acre. The Residency of Soerabaja reported the largest figure (54·89 tons), followed by Besoeki (51·98 tons), while Pasoeroean was lowest in this respect with only 47·00 tons of cane to the acre.

The sugar content of the cane was very good and gave an average sugar extraction of 11·82 per cent. The highest was attained in the Residency of Djokdjakarta with 12·94 and the lowest in that of Besoeki with 10·73 per cent.

The highest average yield of sugar to the acre is reported from the Residency of Soerabaja with 14,808 and the lowest in the Residency of Banjoemas with 12,131 lbs. The maximum figure for one single factory was obtained in the Residency of Djokdjakarta, where Gondang Lipoero estate scored the greatest output of sugar to the acre with 21,431 lbs.

In studying the list of cane varieties planted, it will be seen that 95 per cent. of the planted area is covered with POJ canes, and the remainder with other varieties.

The sugar crop amounted to 2,858,054 tons, of which 2,745,971 tons were first sugars, and the balance consisted of after-products, calculated back to the equivalent of first runnings in ratio of 4 : 3. The figures in the second column of Table III refer, however, to the real weight. Besides the sugar, a quantity of 42,300 tons of solidified and one of 736,700 tons of liquid molasses were manufactured. The exportation of molasses which in former years was insignificant and amounted to 97,033 tons in 1922, 111,151 tons in 1923 and 103,638 tons in 1924, leapt up to 211,231 tons in 1925 as a consequence of an exportation of 96,203 tons to Great Britain, a country that up to then had not imported Java molasses. These exportations and also the shipments to the United States have undergone a steady increase, and they brought the total amount up to about 520,000 tons in 1929. Since some molasses will be necessary for use in the Archipelago for the manufacture of arrack and spirit, the exportation will not rise over 600,000 tons per annum, so that no further considerable increase is to be expected. The price paid is about 15 guilders per ton of 1000 kilos f.o.r.

Table IV shows a little increase in the proportion of the first runnings white plantation sugar, and in the amount of Muscovado ; while the Refining Crystals of 98° polarization have decreased once more.

We also give below the data, relating to the total sales of Java sugars and the portion sold by the United Java Sugar Producers, which body, according to these figures, disposed of 91·0 per cent. of the total Java crop of the year 1929.

Assortments.	Total Sales Tons.		Sales by U.J.S.P. Tons.
Superior " head sugar "	1,927,905	..	1,761,000
Superior soft sugar	11,975	..	7,000
Channel assortment, 98° pol.	675,466	..	644,000
Muscovado	133,964	..	134,000
Molasses sugar	146,469	..	88,000
Total Sales	2,895,779	..	2,634,000

Up to the 31st of December, 1928, the United Java Sugar Producers had sold 762,621 tons of the 1929 crop. On the 4th of January they continued their sales in the year 1929 with prices of 13 guilders per 100 kg. for the whites. On the 7th of June the prices declined to 12 guilders, while on the 10th of July the limit was raised to 12·50. On the 7th of September, 1929, bids were made at 13 guilders, but they were refused ; after raising the level to 13·50 guilders a small amount was disposed of, so that at the end of the year the unsold balance amounted to 176,895 tons.

The 1929 Java Sugar Crop.

I.—Cane Crop.

Residencies and Totals.	Number of Factories.	Land under Cane. Hectares.	Acres.	Cane Harvested. Tons.	Tons. per Acre.	Kg. per Hectare.
Cheribon	11	12,169	30,057	1,490,740	49·63	124,600
Pekalongan	17	18,021	44,512	2,234,211	50·19	126,000
Banjoemas	5	7,172	17,715	864,916	48·79	122,500
Kedoe	2	4,713	11,641	592,147	50·81	127,600
Djokdjakarta	17	17,433	43,060	2,022,631	47·08	118,200
Soerakarta	16	20,175	49,832	2,264,321	47·48	119,200
Semarang	11	11,130	27,491	1,402,811	50·90	127,800
Madioen	6	9,941	24,554	1,222,866	49·79	125,000
Kediri	20	25,435	62,824	3,065,842	48·79	122,500
Soerabaja	35	29,049	71,751	3,940,315	54·89	137,800
Pasoeroean	27	27,351	67,557	3,177,340	47·00	118,000
Besoeki	12	14,496	35,805	1,862,759	51·98	130,500
Total **1929**	**179**	**197,085**	**486,799**	**24,140,899**	**49·59**	**124,500**
,, 1928	178	195,086	481,863	25,295,079	52·53	131,900
,, 1927	178	184,462	455,806	21,113,044	46·04	115,600
,, 1926	178	179,702	444,038	18,683,145	42·08	105,660
,, 1925	179	178,290	439,695	19,023,897	43·19	108,446
,, 1924	179	172,311	424,945	18,029,702	42·36	106,357
,, 1923	179	162,481	401,485	16,078,051	40·04	99,986
,, 1922	182	160,908	397,443	16,759,106	42·05	105,816
,, 1921	183	159,474	394,060	14,939,679	37·89	95,125
,, 1920	183	156,069	385,647	14,398,238	37·34	93,732

II.—Sugar Extracted.

Residencies and Averages.	Kg. per Hectare.	Lbs. per Acre.	On 100 Cane.	Yearly maximum output of any single factory. Kg. per Hectare.	Lbs. per Acre.
Cheribon	14,200	12,669	11·40	18,550	16,551
Pekalongan	14,500	12,936	11·67	17,810	15,859
Banjoemas	13,600	12,131	11·30	15,001	13,384
Kedoe	14,600	13,026	11·62	16,386	14,618
Djokdjakarta	15,300	13,650	12·94	21,431	19,120
Soerakarta	14,500	12,936	12·16	17,661	15,758
Semarang	15,000	13,381	11·74	19,262	17,188
Madioen	15,900	14,183	12·68	20,410	18,211
Kediri	14,400	12,846	11·80	18,510	16,515
Soerabaja	16,600	14,808	12·23	21,370	19,058
Pasoeroean	13,800	12,310	11·84	17,003	15,169
Besoeki	14,000	12,488	10·73	20,000	17,846
Average **1929**	**14,800**	**13,205**	**11·82**	**21,431**	**19,120**
,, 1928	15,100	13,433	11·45	22,010	19,635
,, 1927	12,800	11,413	11·09	20,416	18,247
,, 1926	10,966	9,782	10·38	18,581	16,578
,, 1925	12,881	11,491	11·88	19,399	17,308
,, 1924	11,582	10,326	10·88	18,015	16,097
,, 1923	10,965	9,784	10·97	16,362	14,480
,, 1922	11,226	9,950	10·61	16,362	14,480
,, 1921	10,517	9,321	11·04	17,911	15,875
,, 1920	9,892	8,826	10·55	15,178	13,540

III.—SUGAR PRODUCTION IN TONS.

Residencies and Totals.	First Sugars.	After-Products.	Total Production. After-products as 4 : 3.	Molasses. Solidified.	Molasses. Liquid.
Cheribon	164,876	6,169	169,503	—	46,000
Pekalongan	253,062	4,458	256,406	12,100	63,800
Banjoemas	94,004	2,927	96,199	—	27,600
Kedoe	65,954	2,346	67,714	—	19,700
Djokdjakarta	259,170	2,924	261,363	—	58,800
Soerakarta	279,889	1,790	281,231	—	68,400
Semarang	161,928	3,774	164,759	—	42,200
Madioen	153,817	1,543	154,974	—	40,000
Kediri	336,933	32,946	361,643	—	107,200
Soerabaja	464,583	12,982	474,320	21,900	104,100
Pasoeroean	326,259	58,732	370,308	2,500	102,700
Besoeki	185,496	18,850	199,634	5,800	55,600
Total 1929	**2,745,971**	**149,441**	**2,858,054**	**42,300**	**736,700**
„ 1928	2,776,430	166,339	2,901,751	72,603	694,635
„ 1927	2,279,001	83,111	2,341,538	85,051	566,102
„ 1926	1,890,544	68,142	1,941,649	98,525	593,470
„ 1925	2,205,201	77,876	2,263,479	71,679	546,520
„ 1924	1,924,942	54,427	1,966,237	82,504	483,768
„ 1923	1,740,895	31,655	1,764,636	103,842	Unknown
„ 1922	1,749,640	39,609	1,779,557	62,125	„
„ 1921	1,632,067	34,620	1,658,032	74,892	„
„ 1920	1,497,244	30,060	1,519,562	164,459	„

IV.—SUB-DIVISION OF THE CROP IN PERCENTAGES ACCORDING TO ASSORTMENTS.

Residencies and Averages.	Plantation White Sugar: First running.	Plantation White Sugar: Second running.	Channel Assortment Refining Crystals, 96·5°Pol.	Channel Assortment Refining Crystals, 98° pol.	After-products.	Total.
Cheribon	62·66	1·41	8·18	24·14	3·61	100
Pekalongan	77·07	1·38	1·61	18·22	1·72	100
Banjoemas	0·01	—	20·46	76·51	3·02	100
Kedoe	—	—	25·81	70·75	3·44	100
Djokdjakarta	93·40	—	—	5·49	1·11	100
Soerakarta	99·39	—	—	—	0·61	100
Semarang	89·83	0·84	—	7·05	2·28	100
Madioen	95·90	3·11	—	—	0·99	100
Kediri	73·17	0·50	2·63	14·60	9·10	100
Soerabaja	65·41	—	3·66	28·21	2·72	100
Pasoeroean	33·31	—	9·81	41·63	15·25	100
Besoeki	44·85	—	6·65	39·28	9·22	100
Average 1929	**66·42**	**0·49**	**4·64**	**23·29**	**5·16**	**100**
„ 1928	65·54	0·35	3·44	26·35	4·32	100
„ 1927	63·60	0·30	—	33·50	2·60	100
„ 1926	59·90	0·50	19·70	17·20	2·70	100
„ 1925	56·99	0·55	21·23	18·62	2·61	100
„ 1924	54·45	0·99	16·78	25·69	2·09	100
„ 1923	53·11	1·06	15·20	28·91	1·72	100
„ 1922	52·85	1·53	16·46	27·45	1·71	100
„ 1921	53·42	0·12	15·33	28·05	3·08	100
„ 1920	51·71	0·83	15·08	30·41	1·97	100

V.—Percentage Composition of the Cane Plantings of :—

Variety.	1922.	1923.	1924.	1925.	1926.	1927.	1928.	1929.
B 247	17¼	15½	12½	8¼	4¾	1½	¼	—
POJ 2878	—	—	—	—	¾	12½	66½	93
Various POJ canes	7½	6½	4¼	4¾	6¾	10¾	4¾	2
EK 2	6½	6	6¼	6	5	4	¾	½
EK 28	39	40	43½	45¾	44	35¼	13	2½
F 90	3¼	3	3	2¾	2½	2	½	—
DI 52	18½	21½	22½	24¾	27¾	26	11¾	1¾
SW 3	2½	2¾	3	3	3	2¼	½	—
Various	5½	4¾	5	4¾	5½	5¾	2	¼
Total	100	100	100	100	100	100	100	100

VI.—Exportation of Java Sugar in Metric Tons.

Destination.	1926.	1927.	1928.	1929.
Netherlands	71	33,002	14,823	7,774
Belgium	309	6,122	14,801	17,755
United Kingdom	4	10,791	12,293	25,662
France	618	42,963	77,506	82,958
Germany	10	25,917	14,673	866
Russia and Finland	3,349	—	—	—
Norway	—	—	51	—
Italy	—	309	1,829	6,329
Sweden	—	—	—	12,306
Balkan States	—	7,216	4,267	3,556
Poland	—	1,028	—	—
Other European States	—	308	1,120	—
North Africa	—	—	—	1,043
United States	—	206	4,806	178
Port Said, etc., f.o.	6,388	54,517	206,757	240,380
East Coast Africa	208	3,418	4,499	2,510
Arabia	557	645	13,648	584
British India	753,712	822,481	1,091,296	1,000,291
Aden	3,139	9,620	13,648	4,554
Afghanistan	—	—	—	127
Penang	22,819	24,369	25,213	26,362
Singapore	85,332	83,871	87,687	84,115
Siam	33,750	29,873	27,589	34,201
Indo China	2,462	7,311	8,463	10.593
British Malaya	—	—	—	6,909
Hongkong	184,728	190,892	266,083	261,474
China	167,861	173,474	322,901	312,882
Japan and Formosa	457,681	447,600	265,261	242,705
Vladivostock	—	6,173	3,503	2,608
Philippine Islands	—	173	879	15
Australia	157	513	670	219
New Zealand	—	19,676	52,474	21,065
Polynesia	—	—	—	1,332
Other countries	531	256	13,617	1,028
Total	1,723,686	2,002,729	2,549,990	2,412,381

VII.—EXPORTATION OF MOLASSES.

LIQUID.	1926.	1927.	1928.	1929.
Great Britain	98,969	149,940	62,167	31,433
United States (Pac. C.)	—	—	12,386	12,483
„ „ (Atl. C.)	—	—	12,223	—
Aden f.o.	—	—	248,353	363,151
British India	51,401	64,124	41,436	47,303
Straits Settlements	107	293	1,453	—
Siam	852	311	—	—
Hongkong	13,896	16,186	18,036	19,179
China	6,846	2,187	875	266
Union of South Africa	—	—	10,439	—
Australia	114	113	—	—
Italy	7,778	—	—	—
Balkan States	—	4,064	—	—
Total	179,963	237,218	407,368	473,815
SOLIDIFIED.				
Egypt	—	—	1,111	—
British India	56,941	48,157	32,462	23,798
Siam	19,030	16,216	14,085	14,131
Straits Settlements	2,671	3,065	2,281	2,230
Indo China	979	737	783	891
Hongkong	317	5,226	8,825	1,501
China	3,921	3,330	6,386	1,532
Australia	271	133	252	1,015
Total	84,130	76,864	66,185	45,098
GENERAL TOTAL	264,093	314,082	473,553	518,913

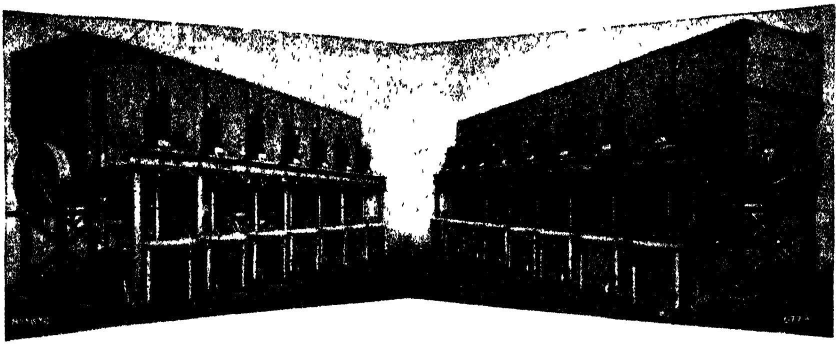
Prices were still declining and in the month of April the last sale was made at the price of 9 guilders per 100 kg. for the whites, leaving only 42,500 tons of white sugar to be sold. The average price of the sugar in guilders per 100 kg. made by all manufacturers in the island works out as follows :—

	Guilders.
Superior " head sugar "	12·67
Superior soft sugar	14·00
Head sugar and Muscovado	11·47
Molasses sugar	10·75
Average	12·22

We estimate the consumption in the territory of the Dutch East Indies at 362,000 tons, all the balance being available for export.

The destination of the 1929 export was as detailed below in metric tons, and we give the corresponding figures for two previous years as a comparison. The stocks of sugar still existing at the beginning of the 1929 grinding season are put at 9833 tons and on the 30th of April, 1930 they were 145,000 tons.

The Table given in previous Reports in this Journal, detailing " Factory Results," is not available this season, as it was only issued privately and the Board of the Experiment Station have withheld permission to make the figures public.



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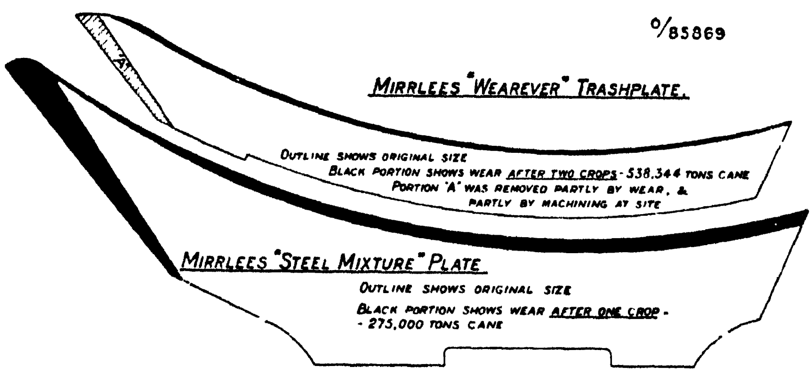
An Improved Construction for Sugar Mill Trashplates and Scraper Plates.

The Mirrlees Watson Co. Ltd., of Glasgow, has in recent years been devoting a considerable amount of attention to the development of a material for Trashplates and Scraper Plates which will give longer life than ordinary steel or steel mixture, known in the United States as " " Semi-Steel."

The necessity of operating cane sugar mills at high capacity has compelled factory owners to adopt deep grooving of their mill rollers, with a consequent increase in the wear of trashplates and scraper plates ; also, owing to the necessity of serrating or grooving trashplates and scraper plates to mesh with the deep grooving of the mill rollers, the cost of these parts is increased, hence it becomes important, if operating costs are to be reduced, that they be made of a material which will resist wear.

Two qualities of material are now offered—" Wearever " steel and " Durable " cast-iron. The " Wearever " steel is a high-grade alloy steel of great hardness, consequently the costs of the material and machining are considerably higher than those of ordinary steel or cast-iron. The factory in which this quality of steel was first used is now using it throughout. The accompanying diagram shows the wear of the top surface of a " Wearever " trashplate after grinding 538,344 tons of hard cane-- two crops. The wear varied from $\frac{1}{16}$ in. to $\frac{3}{32}$ in., whereas the wear of a steel mixture plate in the same factory was from $\frac{3}{16}$ in. to $\frac{5}{16}$ in. when grinding 275,000 tons of cane—one crop. We learn that this trashplate has now successfully completed its third crop, bringing the total to 888,000 tons of cane.



" Durable " cast-iron is an alloy cast-iron which costs little more than ordinary steel mixture, but is of much greater hardness.

It is always advisable to have the makers completely machine these special plates as, owing to the hardness, it may be found difficult to machine them with the ordinary machines and tools available at a sugar factory. The makers' works are specially equipped for the serrating of these parts to match the mill rollers, special automatic machines having recently been purchased to carry out this work.

Replace parts can be made for any make of milling plant on receipt of a template showing the cross section of the part required, together with details regarding the length, grooving and drilling.

For a limited period, and in order to permit all operators to satisfy themselves of the superiority of this new alloy, the makers are offering one trashplate, or two scraper plates, of their " Durable " quality material, to any one factory, at the same price at which ordinary steel mixture parts can

be purchased. A similar offer cannot be made in regard to the "Wearever" quality, as the cost of this quality is very considerably greater than that of the ordinary trashplate or scraper plate; nevertheless, the great advantages of the long life obtained from this material are such as to justify the fitting of this quality throughout the milling plant of one large factory where it was first tried out, and where the superiority is fully appreciated.

The "Werkspoor" Rapid Crystallizer.

By R. BONATH.

Modern massecuite practice aims at reducing pan work. As much sugar as possible should be recovered from one strike, the repeated concentration of syrups and molasses being avoided as far as practicable. Many efforts have been made in the past to design plant for effecting the rapid cooling of the massecuite, combined with the better exhaustion of the syrup and molasses, and consequently also an increase in the yield.

An early method was to operate several ordinary crystallizers in series, relying on the surrounding air for the lowering of the temperature. Further developments were crystallizers with cooling jackets or with external spray cooling, and subsequently fixed internal tubular systems were adopted.

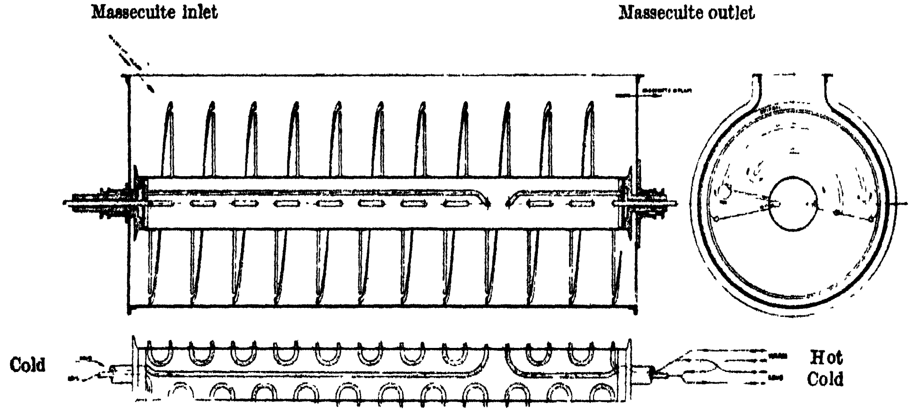


FIG. 1. WERKSPOOR rapid Crystallizer. Longitudinal section.

These devices present various disadvantages, as insufficient cooling effect, much floor-space, undercooling of some portions of the massecuite with the consequent formation of crusts or false grain. Externally cooled crystallizers are especially subject to the last mentioned disadvantage, being moreover far from efficient.

A more radical and successful solution was first found by LAFEUILLE, who introduced a fixed tubular system, around which the hermetically closed cylinder containing the massecuite rotates. Its success was such as to draw the attention of sugar manufacturers and refiners to it as a means of simplifying sugar-house work. Various tests with the Lafeuille rapid crystallizer have given a new insight into the problem of massecuite cooling, and have led to the establishment of the requirements which an efficient apparatus of this kind should fulfil.

Of these requirements the most salient are the following : (1) Shortening of the period of crystallization, which is achieved by the introduction of very large cooling surfaces. (2) Avoidance of the formation of false grain, which is realized by uniformly distributing the cooling effect throughout the crystallizer, thus preventing large differences of temperature locally. As is known, false grain is the consequence of too great a difference in temperature between cooling surface and massecuite, combined with insufficient circulation. In that case the syrup is cooled too rapidly in some places with the result of local supersaturation and the consequent formation of new fine crystals or false grain. (3) Simple and substantial design, which means the elimination of revolving tubular systems.

Keeping these requirements in mind, the Dutch firm of Werkspoor has succeeded in developing an improved type of rapid crystallizer, claimed to give even better results than LAFEUILLE's, whilst avoiding the drawbacks of

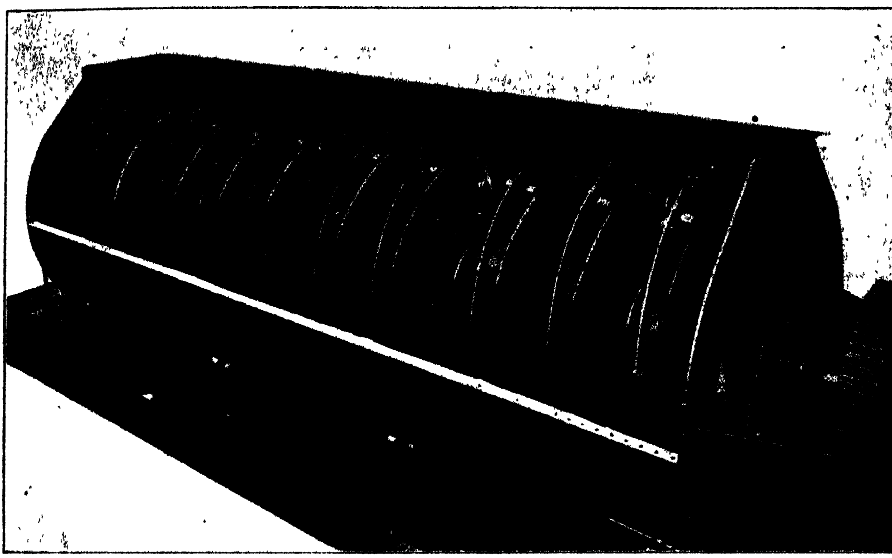


FIG 2. WERKSPOOR rapid Crystallizer with bulb shaped trough. One side plate has been removed to show the interior arrangement of the water-cooled stirrer and bulkheads.

this and other systems. They adhere as much as possible to the usual general design of crystallizers, i.e., the use of a stationary trough and a revolving stirring system, which latter, however, is provided with internal water circulation. A further demand is the continuous working of such a crystallizer. The resulting type is capable of replacing existing crystallizers in their original position, by which the cost of installation is greatly reduced. A longitudinal section is shown in Fig 1.

The Werkspoor rapid crystallizer, specially designed for the treatment of second products, is claimed completely to eliminate the following defects : Large requirement of floor space, the impossibility of emptying the drum completely, and the difficulty of adding syrup or water during the period of stirring. The trough may be either U-section, or still better of bulb or bottle shape (Fig. 2). The revolving, water-cooled stirring system consists of a hollow drum of large section, rivetted to which are a number of semicircular hollow cooling pockets (Fig. 3), coupled by suitable pipe connexions

inside the central drum. Through these the cooling water circulates. The cooling pockets themselves are sub-divided internally by suitable deflectors to guide the stream of cooling water systematically. One can obtain access to the interior of the pockets, thereby permitting their cleaning without removing the stirring system from the trough.

The transport of the massecuite from one end of the crystallizer to the other is effected by a screw-shaped element placed outside and independently of the cooling pockets. By the introduction of a certain number of fixed partitions, the massecuite is prevented from flowing backwards, faulty circulation being thereby prevented. The massecuite is thus pushed on continuously and evenly, the cooling water being circulated in the opposite direction, thereby ensuring a perfect counter-current action. The difference of temperature between the surfaces and the massecuite is kept constant during the whole cooling period with the temperature falling gradually and uniformly from inlet to outlet.

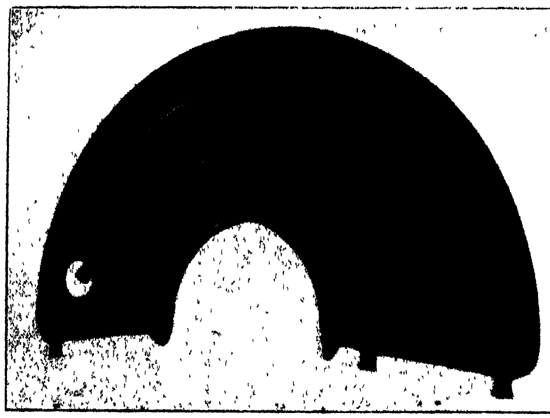


FIG. 3. WERKSPOOR rapid Crystallizer. Cooling Pocket.

The outlet is provided with an adjustible overflow by means of which it is possible to obtain perfectly continuous operation, though it is also possible to empty the trough at once completely. Propelling the massecuite in a pre-determined manner, together with the counter-current effect, are the two main characteristics of the Werkspoor design, and these constitute a marked improvement over other types. The driving of the water-cooled system is the same as in ordinary crystallizers. The contents of the apparatus are open to inspection during the whole of the cooling period, and water or syrup may be added as may be desired. Massecuite which after cooling down proves too viscous to be treated in the centrifugals, may be re-warmed again by passing hot water through the discs. This may also be done in counter-current, and a second system of circulating tubes and connexions may be placed for that purpose inside the central drum.

The first of these crystallizers was supplied to the Poerwodadie factory, Java, and the results obtained with it were so satisfactory as to lead to several repeat orders. That crystallizer had a total capacity of 250 hl. (about 880 cub. ft.); its duration of cooling was from 2 to 2½ hours; and the power required was about 5 h.p. when working with one revolution per minute of the stirrer shaft. The transmission of power is by double machine-cut gearing of heavy and modern design with ring-oiled bearings and ball-thrust block. Regarding its operation, Werkspoor received the following report: "When cooling at the rate of about 90 hl. (about 315 cub. ft.) per hour, an exhaustion of about 5 points is reached. This result must be considered excellent, especially as no false grain is formed in these crystallizers."

Recent Work in Cane Agriculture.

CANE VARIETIES, MOSAIC DISEASE AND FERTILIZERS IN THE WEST INDIES. **Otto Hach.** *Facts about Sugar.* April 19th, 1930.

This article, among other matters, opens up a question of interest with regard to the damage done by mosaic, which has been somewhat in the background of late years, but finds a place in EARLE'S recent book on the sugar cane, namely, the use of fertilizers in minimizing the effect of mosaic on the crop. HACH draws attention to two well authenticated instances mentioned in this book. The first is of a well cultivated and manured field of fall planted canes, in the irrigated tract along the south coast of Porto Rico. In this field, although it was 90 per cent. infected with mosaic, a yield of 51 tons of cane was obtained per acre, as against a possible 65. The second instance is drawn from the north coast of the same island. Here a field of old ratoons had become infected to the extent of 95 per cent., and the yield had fallen off to 5 tons of cane per acre in consequence, under the current methods of cultivation. It was, however, taken in hand, deeply off-barred after harvest, given a double dose of complete fertilizer, good implemental cultivation and two or three irrigations, with a final application of ammonium sulphate before closing in. The production jumped to 25 tons, " showing that infected fields will respond to better cultivation." EARLE also states that the effects of the disease are always worse on old, poor land, and especially in cases of severe drought.

But he puts down the improvement in these cases to the application of nitrogenous manures, and in this HACH differs from him ; and suggests that it was not the nitrogen, but the double dose of complete manure that was responsible for the notable increase in yield. And he strengthens his argument by referring to an experiment by MARI, designed to compare the susceptibility to mosaic in BH 10 (12) and POJ 2725. These canes were planted in rows alternating with 100 per cent. infected POJ 36. At harvest BH 10 (12) was infected to the extent of 73 per cent., while POJ 2725 showed up as immune. But it is with the manuring of the plot that he is chiefly concerned : this consisted of simply giving 2 oz. of ammonium sulphate to each plant, in place of the usual practice in MARI'S plantation of using complete manure. The yields of POJ 36 and BH 10 (12) were very poor, being 10·46 and 16·7 tons per acre respectively. The yield of POJ 2725 was better (35·15) but was well behind the customary yield of this variety in Porto Rico (43 to 69). These figures, the author holds, do not support EARLE'S advocation of nitrogenous manures for mosaic infected plants.

Assuming, then, that applications of complete manure will be more likely to lessen the damage done by mosaic than of nitrogenous manures alone, HACH compares the known effects of the remaining constituents, phosphates and potash, on the growth of crop plants. While the former is of use in the formation of a widely spreading root system, potash is recognized as having a tonic and strengthening effect on the whole plant. And he supports this view by referring to the action of potash in combating fungous diseases in tobacco, potatoes and cotton. Although not claiming that potash will reduce the amount of mosaic infection, he considers that high applications of this fertilizer " will strengthen susceptible varieties of sugar cane to such an extent that they may become tolerant to a large degree." In cases where susceptible varieties such as Cristalina, BH 10 (12) and SC 12 (4) are planted " the fear of mosaic alone does not necessarily constitute a reason for discarding these varieties. If careful roguing is practised from the start, and heavy appli-

cations of a complete fertilizer high in potash are given, not only is the danger that mosaic will appear minimized, but, if it should appear, its yield reducing effect on the cane and its lowering of sucrose content will be counteracted successfully."

To this advocacy of potash as a tonic to crop plants we may merely add HARLAND's investigations of "red leaf" in the cotton plants in St. Vincent, which is accompanied by a serious diminution in the robustness of the plants and consequently by a diminished yield. Red leaf is not caused by a fungous disease, but has been traced to a deficiency of potash in the soil, and at once disappears when this fertilizer is applied. For the rest, HACH does not refer to any experiments made by himself, and we therefore assume that he has relied solely on those of others, and his interpretation of their results. He would have greatly strengthened his argument if he had conducted such experiments himself, with this imputed action of potash in view.

POTASH NOT A PANACEA. **E. W. Brandes.** *Facts about Sugar.* May 10th, 1930.

While preparing the above review we had the opportunity of reading a proposed article by BRANDES who courteously forwarded a typed copy, intimating that the matter was important and should have wide publicity. It is difficult to review this article, now that it has been printed, because, in the first place it is in the nature of a philippic (according to the dictionary, " any discussion full of acrimonious invective "), and in the second because the author has been very chary in giving facts in support of it. The opinion of BRANDES on anything to do with mosaic deserves attention, but in the present case he seems to have put a construction on HACH's remarks different to that which we have done. He appears to be particularly averse to the continued planting of Cristalina, presumably in Cuba ; but does not take cognizance of the difficulty there of replacing it. HACH deals with this matter somewhat fully and agrees with EARLE that even the highly resistant POJ 2725 has not the necessary adaptation to the local conditions to be able to replace this widely planted old cane. BRANDES takes as his example of replacement the great success which Louisiana has made with the older tolerant POJ's ; but for a country like Cuba, capable of growing good tropical canes, to follow suit with those canes would obviously be a very dangerous experiment. As HACH says, their planting "serves to propagate rather than exterminate the disease."

But, as the title of the paper indicates, this denunciation is chiefly directed against the prophylactic use of potash fertilizers, in lessening the damaging effect of mosaic. After pointing out that, with such treatment, the plants remain affected, the author writes : " What is worse, the temporarily stimulated diseased plant is an even more effective source of the inoculum than an infected plant that has not been toned up like a worn-out horse doped with arsenic. This is all old stuff, a closed chapter in the book of the sugar cane industry's war on mosaic. The relation of fertilizers and sugar cane mosaic was published by the present writer eleven years ago. The article under discussion adds nothing new to the facts known then, but does make a fallacious and dangerous interpretation of them." It would have served a useful purpose if the author had enlarged this paragraph sufficiently to include some of the evidence which shows that HACH's conclusions are without foundation. We have searched through the literature available to us for any specific statements on the effect of potash manures on mosaic infected plants, but without success.

STUDIES IN SUGAR CANE POLLEN WITH SPECIAL REFERENCE TO LONGEVITY. **N. L. Dutt.** *Agricultural Journal of India.*, Vol XXIV, Part IV, July, 1929.

This is a continuation of the author's exhaustive investigations into a matter of great importance in the raising of cane seedlings.[1] The whole subject of sugar cane pollen and its literature is touched upon, and several improvements have been worked out in the highly specialized technique employed. The following summary is printed at the end of the paper, although it might have been with advantage considerably extended : it gives no idea of the mass of experiments leading to these and other results.

(1) In the fresh and dry condition sugar cane pollen varies in size from $38{\cdot}25\mu \times 42{\cdot}75\mu$ to $67{\cdot}5\mu \times 72{\cdot}0\mu$. It contains about 48 to 51 per cent. moisture.

(2) Sugar cane pollen was found to germinate in quite a wide range of sugar concentrations, or in distilled or filtered rain water alone. Filtered rain water could without detriment be substituted for distilled water as solvent in the medium. A definite sized ring and air proof condition of the moist chamber are not absolute pre-requisites. The best germinations were, however, obtained by using 26 per cent. *commercial* sugar plus 0·7 per cent. shred agar.

(3) The maximum length attained by a sugar cane pollen tube, under artificial culture, was obtained in POJ 2696 pollen, where the tube measured 2021μ after three hours ; and as the sugar cane pistils measure less than this (between one tenth and one twelfth of an inch), it may be said that under favourable conditions the sugar cane pollen tube would reach the ovary in about 3 to 4 hours.

(4) Mauritius 131 pollen was kept alive in store for 12 days, over 85 per cent. relative humidity, in an atmosphere of CO_2, and at temperatures varying from 5°C. to 13°C.

SUGAR CANE DISEASES IN SOUTH AFRICA. **A. P. D. McClean,** Government Mycologist. (Read at the Annual Meeting of the South African Sugar Technologists' Association).

The following appear to be the chief points of import in this interesting paper. Natal, the author observes, is in a singularly favourable position, in that no pest or disease has seriously depreciated the crop during recent years. And this is all the more surprising, considering the wholesale introductions of cane varieties at the end of the last century, with totally inadequate quarantine arrangements. This latter matter has now been rectified. Every sugar cane plant on arrival is fumigated and disinfected : it is then grown for one or two years in a specially constructed quarantine greenhouse; and after this is grown in open quarantine in the plots of the experimental station for an indefinite period. In spite of this absence of serious loss in the fields, there are two diseases of the virus type which are widely spread and require careful study, mosaic and streak. These are of course ineradicable ; but they harm the plant by impeding the metabolic processes, thus causing stunting and loss of vigour. Generally these effects are cumulative and become more pronounced with the lapse of time.

With the replacement of the tropical or noble canes by Uba at the end of last century, mosaic as a destructive agency has never been a serious consideration. Its presence was first announced by STOREY in 1923, although it probably existed in the country for some years previously. It was found to be

[1] *I.S.J.*, 1929, 256-258.

widely spread among the tropical canes still being grown, for the most part in small isolated patches by Indian settlers, to the extent of 0·2 per cent. of the cane under cultivation. And if other canes were to be introduced to fall back upon if Uba failed from any cause, STOREY quickly realized that it would be of no use to do so unless all these isolated patches were cleared out completely, with the mosaic with which they were infected. The necessary legislation was adopted in 1927, and has been completely successful, *as regards the canes.*

But this action has not been so successful in giving Natal a clean bill of health for mosaic, since a number of the introduced plants have exhibited outbreaks of this disease when grown in open quarantine : D 1135, Badila, 1900 Seedling, Q 813, Gingor, Clarke's Seedling, UD 1, SC 12 (4), and Co 205. It therefore became necessary to test the susceptibility of all imported cane varieties ; and this was done in special large cages where the following have, thus far, remained unaffected by the disease, although exposed to intensive infection from diseased plants by *Aphis maidis* : Wade's Selection, CH 64 (21), Morthi, Zwinga, Hinde's Special, CO 214, Co 290, US 663, and POJ's 2727, 2725, and 2714.

There are two ways which have been discovered, in which this infection of the open quarantine plants may have occurred, namely, by the survival of volunteer ratoons of tropical canes in the Uba fields, and through infected wild grasses. It is hoped to be able to remove the former danger by inspecting the Uba fields, row by row ; and the results obtained thus far have been highly encouraging ; but the perennial grasses are a different matter and a greater danger. One of them, *Setaria sulcata,* has been definitely determined as being infected by mosaic and capable of infecting sugar cane. As a result of careful study it has been noted that diseased plants of this grass are very rarely found far from sugar cane fields, and that among such cases of infection, the number of plants attacked is very small. It is thus considered that " a system of eradication is not outside the realm of practicability." The time is fast approaching " when consideration must be given to the replacement of Uba in certain areas by the varieties which are now being propagated in quarantine at the experiment station," and the author looks to the varieties excellent in quality and with a high measure of mosaic resistance, which are being produced by cane breeders.

As to Streak, some 18 varieties, "noble, Chinese, and North Indian types," have been found showing symptoms of the disease. But the Coimbatore and later Java seedlings, POJ's 2725, 2714 and 2878, have been exposed in localities in which one can normally expect almost 100 per cent. secondary infection within 12 months ; and they have in every case remained in an apparently healthy condition. The disease was first announced by STOREY in 1924, although there are records of it dating back to 1914, and a similar condition was known in maize much longer. Uba, however, is largely tolerant ; though as the result of a series of experiments on two separate occasions. 1923-1925 and 1927-1929, the loss was estimated at from 10 to 13 per cent. Streak has proved to be readily controllable by selection and roguing, where the degree of secondary infection is small. But, in Zululand and parts of Natal south of Durban, where secondary infection is rapid, and fields with healthy plant material become 100 per cent. infected in 12 to 18 months, the planting of resistant varieties is the only satisfactory means of control.

Short sections follow on other diseases met with in the fields, for the most part unimportant as regards Uba, but probably of greater significance if it

is replaced by other varieties. The ones mentioned are : Ring spot (*Leptosphaeria sacchari*), Eye spot (*Helminthosporium sacchari*), Red rot of cane stems (*Cephalosporium sacchari*), Rind disease (*Melanconium sacchari*), the Root disease complex, and various forms of Chlorosis, simple, cold and sectional. None of these are major diseases such as are found in many other countries.

C. A. B.

Atlanta Meeting of the Sugar Section of the American Chemical Society.

Dr. Wm. L. Owen acted as Chairman at the Atlanta, Ga., meeting of the Sugar Division of the American Chemical Society, April 7th to 11th, and following are abstracts of some of the papers presented :—

Colloids in granulated sugar : a practical problem.—**C. F. Bardorf.** As all granulated sugars contain colloids (presumably of cane-wax complex) the question as to the influence of these colloids on the permanency of aerated beverages is discussed. It is pointed out that certain sugars of excellent quality and low colloid content seem to give less satisfactory results than sugars demonstrably carrying more dispersoids. A table showing the relative qualities of ten sugars and their tendency to produce flocculations suggests the peculiar nature of the problem as far as the author has been able to carry investigations to date.

Decolorization of cane and refinery syrups with decolorizing carbons.—**E. W. Harris.** Decolorizing carbons can be successfully used for the preparation of cane syrups, thus eliminating sulphitation and producing syrups of uniform taste and colour. Tests on refinery syrups indicate that decolorizing carbons may play an important rôle in the future as an adjunct to bonechar.

Unified method for the conductometric determination of ash in refinery syrups.—**F. W. Zerban and Louis Sattler.** In a preceding paper it was shown that the conductometric formula which corrects for differences in the proportions of various anions in raw cane sugars can, under comparable conditions, be used for the determination of ash in syrups and molasses produced in raw sugar factories. For refinery syrups, however, the factor in the formula has to be changed to suit each individual class of product of each individual refinery. It has been found that the abnormal behaviour of refinery products is due to a change in the proportions of the various cations through treatment with boneblack. An additional conductance determination in the presence of alkali makes it possible to establish a second correction and to develop a unified formula for refinery syrups. The percentage of ash in these products equals $0{\cdot}01757\ (1{\cdot}33\,K + 498{\cdot}3 - 0{\cdot}091\,K_1 - 0{\cdot}5\,K_2)$, if 0·5 grms. of syrup plus 4·5 grms. pure sucrose are dissolved to 100 ml. K is the specific conductance $\times\ 10^6$ of the solution ; K_1 that of 200 ml. solution plus 5 ml. 0·25 normal hydrochloric acid ; and K_2 that of 200 ml. solution plus 5 ml. 0·25 potassium hydroxide solution, all at 20°C. If the addition of sucrose is omitted, the formula is $0{\cdot}01640\ (1{\cdot}064K + 434{\cdot}4 - 0{\cdot}089\,K_1 - 0{\cdot}25\,K_2)$. Those formulas do not apply to syrups and molasses from the raw sugar factory, for which the original conductometric formula gives better results.

Effect of dextrose and of sucrose on the determination of levulose by Nijns' method.—**F. W. Zerban and Louis Sattler.** Nijns uses a copper solution which contains the same quantities of potassium carbonate and bicarbonate as

OST's solution, but only 15 grms. of crystallized copper sulphate to the litre, instead of 23·5 grms. as employed by OST or 25·3 grms. as ascribed to OST by NIJNS. NIJNS states that his solution completely oxidizes levulose at 48·5 to 49°C. in 2·5 hours, when 50 ml. copper solution and 20 ml. sugar solution containing not over 0·3 per cent. of levulose are used, but that it has practically no effect on dextrose or sucrose under these conditions. A repetition of NIJNS' work with levulose alone gave a smoother curve than that shown by NIJNS, and it was found that m mg. levulose reduce ($3·6\ m$ — $0·004\ m^2$ — 6·9) mg. copper. At medium concentrations of levulose, around 0·15 per cent. and with about the same quantity of dextrose added, one mg. of the latter reduces 0·27 mg. copper. At high concentrations of levulose and of dextrose the effect of the dextrose is distinctly smaller. When sucrose is added to levulose-dextrose mixtures, m grms. sucrose reduce m ($4·1$ — $0·55\ m$) mg. copper.

A volumetric method of determining aldose sugars by the iodine-alkali oxidation reaction. **C. S. Slater and S. F. Acree.** Under specified conditions aldose sugars react quantitatively with two equivalents of iodine and form two equivalents of hydroiodic acid and one of the aldonic acid. By neutralizing the sugar solution and adding both standard iodine and alkali in several portions until a small excess of each is present, and allowing the mixture to stand about fifteen minutes, the excess of iodine, alkali, hypoiodite and iodate can be determined by means of standard thiosulphate and acid with starch and phenolphthalein as indicators. Several variables are studied. The aldoses, glucose, lactose, galactose, and xylose use or remove two equivalents of iodine and three of alkali, whereas xylans, galactans, fructose, and sucrose remain practically unchanged. The method has been applied extensively in the analysis of solutions of xylose made in the semi-commercial hydrolysis of the xylans of cottonseed hull bran, bagasse, peanut hulls, and straw.

The measurement of turbidity.—**C. D. Ingersoll and R. E. Davis.** The measurement of turbidity in filtrates has long been a problem not only in sugar refineries but in chemical industry in general. Previous means of measuring turbidity have been vitiated in part by the concomitant unavoidable measurement of colour of the filtrate. This method is based on reflection of light from a Tyndall cone through a filtrate film approaching zero thickness. The turbidity of the solution is measured by observing the Tyndall cone through a cone-free solution of potassium dichromate saturated at 20°C. The turbidity is designated as the number of centimetres of dichromate solution which obliterates the cone. On dilution of turbidities found in house-sugar liquors with cone-free sugar solution, the turbidity is inversely proportional to the dilution until the extreme high dilutions are reached when the turbidity drops off rapidly

The value of Melilotus Indica in growing sugar cane.—**C. E. Coates and E. A. Fieger.** The amount of nitric nitrogen produced during a period of six months in a Louisiana cane soil through burying *Melilotus Indica* is compared with applications of sodium nitrate. Comparisons are also made with results from plots having cane trash burned and cane trash ploughed under with and without *Melilotus Indica.* The results indicate that *Melilotus Indica* supplies as much available nitrogen as applications of sodium nitrate at the rate of 250 lbs. per acre. The increased nitrate content was only obtained during the season the legume was turned under. *Melilotus Indica* on plots having trash burned and trash ploughed under gave 75 per cent. and 100 per cent. increases respectively in nitric nitrogen content in comparison with plots having trash burned.

Atlanta Meeting of Sugar Section of American Chemical Society.

Effect of metallic salts as stimulants in the alcoholic fermentation of molasses. —**F. M. Hildebrandt and F. F. Boyce.** It is well known that small amounts of certain metallic salts have a stimulating effect on green plants and the fungi. The work of Raulin on the use of zinc salts in media for growth of certain moulds is a case in point. It is possible to produce a slight but definite increase in the yield of alcohol from yeast fermentation of cane molasses by the use of these inorganic salts. Manganese and copper salts were used with success, and cyanides of potassium and sodium were also effective. The stimulating effect was found to be more certain and consistent if the stimulants were put in the yeast stage preceding the final fermentation. This yeast, treated with a suitable concentration of the salts, when put into a second solution of molasses to which no salts have been added, will give a higher yield of alcohol than untreated yeast. The use of the stimulants in the seed stage only makes it possible to control their action and also reduces the amount of salt necessary to a very low figure. This technic of utilizing the stimulating effect of these salts makes their employment possible in industrial fementations of molasses.

The structure of sucrose.- **C. S. Hudson.** Some years ago the author showed that sucrose can be hydrolysed within a few minutes of low temperature in nearly neutral solutions by the use of very strong preparations of invertase and that the hexoses which are thereby initally liberated are alpha glucose and a new form of fructose. The alpha glucose is now known to possess the 1,5 oxidic ring, and it is shown that the fructose modification possesses the 2,4 ring and is a beta form. These results show that the full structure and configuration of sucrose is that indicated by the designation of 2-[alpha-d-glucoside (1,5)]-beta-d-fructose 2,4).

Other papers presented included the following: *Carbohydrates of some Indian Plant Foods.* - **E. Yanovsky.** *Diastatic activity of some American Honeys.*—**R. E. Lothrop and H. S. Paine.** *Solubility of sucrose in the presence of certain alkali salts.*—**R. F. Jackson and C. G. Silsbee.** *Selective reduction methods for levulose.*--**R. F. Jackson.** *Oxidation of xylose with nitric acid.*—**G. M. Klein and S. F. Acree.** *Chemical problems in connexion with the sugar cane industry.* --**C. E. Coates.** *The preparation and recognition of an unstable methylated mannose.*—**Carrell H. Whitnah.** *The alpha and beta methyl-d-galactosides and their tetraacetates.*—**J. K. Dale and C. S. Hudson.** *Some new derivatives of gentiobiose.*—**B. Helferich and J. F. Leete.** *The homogeneity of inulin.*- **R. F. Jackson and Emma M. MacDonald.**

CHLORINE DISINFECTION.—Disinfection of the milling plant, gutters, strainers, etc. has been recommended in India, Mauritius, and elsewhere, using so-called "E.C." (electrolytic chlorine) for the generation of which a special apparatus is required. In this connexion it is worth noting that a stable form of chloride of lime is now on the market. It is of constant composition, 38-40 per cent. of active chlorine stable even at 50-80°C., free from pungent smell, rapidly and easily soluble in water, and forms a powder which does not cake. This material, if sufficiently cheap, would form an ideal preparation for maintaining mill sanitation.

POJ 2878 IN THE P.I.—POJ 2878 has exhibited three rather serious defects in the Philippines to date. It has given poor juices; it tassels commonly in October and November, and it lies down as a result of strong winds or heavy rains.[1] It has, however, developed hitherto unknown advantages. It is very resistant to mosaic disease, leaf scald and also to rat injury. In addition, it is the most resistant to standing water of any Philippine cane varieties, and since standing water is one of the most injurious factors on the lowlands of Negros, this one character will probably more than compensate for its disadvantages which, too, can be to some extent remedied.

1 ATHERTON LEE in his Director's Report to the Philippine Sugar Association.

Beet Agricultural Notes.

Sugar Beet Variety Trials.

During the three seasons, 1927-29, the National Institute of Agricultural Botany carried out trials with 11 strains of beet at three of the Institute's sub-stations, viz., the Norfolk Agricultural Station, near Norwich, the Harper-Adams Agricultural College, Newport, Salop, and at Good Easter, near Chelmsford, Essex. An account of these trials is given by S. F. Armstrong.[1] The soil at the first two places was moderately light and of open texture, while that of the latter was a strong boulder clay with strong clay sub-soil. Climatic conditions in the three seasons were markedly different. Interference by diseases or pests was negligible. The trial method adopted involved the use of 10 plots of each variety, the probable error being about 2 per cent. In the following table appear the general average results of all the trials made, the strains being arranged in the order of their average value per acre :

Strain	Average Weight of washed beets Tons per acre.	"Bolters" Per cent.	Average Sugar content Per cent.	Average Yield of sugar per acre Tons.	Average Value of roots per acre £ s. d.
Kleinwanzleben *E*..	13·07	2·32	17·3	2·26	33 15 3
Dippe *E*	12·81	5·58	17·3	3·23	33 1 10
Strube *E*	11·83	5·54	18·1	2·14	32 2 9
Hoerning *H.S.*	12·23	2·80	17·5	2·13	32 0 0
Zapotil *II*	11·76	3·56	18·1	2·14	31 18 11
Gartons' 426	11·82	5·26	18·0	2·14	31 18 3
Kuhn *P*	11·56	1·12	18·0	2·07	31 4 3
Schreiber *S.S.*	11·51	2·67	17·8	2·05	30 13 10
Marsters	10·98	0·22	18·5	2·02	30 11 2
Vilmorin *B*	11·74	5·06	17·4	2·05	30 10 6
Janasz	9·87	9·26	19·0	1·88	28 5 11

Kleinwanzleben-*E* produced larger roots than any other, but is bracketed with Dippe-*E* in having the lowest sugar content. But it gave the highest yield of roots, the greatest yield of sugar, and the highest returns per acre of any variety, except at Good Easter, where it came below Dippe-*E* in each of these respects. It has never bolted badly ; is fairly free from fangs ; and produced a satisfactory amount of top. Dippe-*E* gave consistently high yields in all seasons. In its yields it was only exceeded by Kleinwanzleben-*E*. But it was more difficult to lift, prone to bolt, produced a rather large top, and had rather more than the average number of fanged roots.

Strube-*E* gave good returns on an average ; as did Hoerning-*HS*. Zapotil-*II* does not appear to merit any special attention ; Gartons-426 gave no better returns. Schreiber-*SS* and Vilmorin-*B* had no outstanding merits. Kuhn-*P* was surpassed or equalled in value by both Kleinwanzleben-*E* and Hoerning-*HS*. Marsters gave average returns lower than all strains except Janasz and Vilmorin-*B*.

On farms where the conditions resemble those at any of the three stations the preference should certainly be given to Kleinwanzleben-*E*. Dippe-*E* on Essex clay also merits consideration. Marsters and Kuhn-*P* appear to be very suitable for growing on rich black land or deep silts, where leaf development is encouraged to such an extent that lifting operations are difficult when big-topped strains are grown. But whether they would be more profitable to grow than large-topped strains under such conditions can be ascertained only from reliable trials.

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[1] *Journal of the Ministry of Agriculture*, 1930, **37**, No. 1, 63-69.

Beet Agricultural Notes.

The Best Cultivation Conditions.

A. W. Oldershaw, Agricultural Organizer for East Suffolk,[1] states what he believes to be the best conditions for securing good crops : The first is fertile land ; frequent applications of farmyard manure in the course of the rotation are a great help. Good crops of clover and other legumes leave an abundant root residue which is of the greatest importance in increasing the fertility of the land. Artificial manures are of more benefit than is generally realized in increasing the root residues left by all crops ; they are of especial benefit when they increase the yield and extend the root system of leguminous plants, so increasing the percentage of nitrogen in the soil. It is extremely important that the land should be clean. In a favourable autumn, such as that of 1928 or 1929, tillage operations immediately after harvest are of great benefit, as the land receives what in many cases almost amounts to a fallow. Sub-soiling has usually proved decidedly beneficial.

Farmyard manure may be applied, preferably in autumn. Complete dressings of artificial manures should also be given. Phosphates are probably best applied in the form of super-phosphate or other water-soluble phosphate at the rate of from 3 to 4 cwt. per acre on light land, to about 5 or 6 cwt. per acre on heavy land. The phosphate should be worked into the land before the seed is drilled. Potash may be applied in various forms. As a rule, less potash is needed on heavy land than on light. For average land 5 cwt. per acre of kainit, applied in February or March, or 2½ to 3 cwt. of 30 per cent. potash salts applied in March, or 1½ cwt. muriate of potash applied at the same time as the superphosphate will be found a suitable dressing. Potash manure salts have been found in some cases to be particularly well suited for sugar beet.

Nitrogenous manures may be applied in the form of sulphate of ammonia, nitrate of soda, nitrate of lime, nitro-chalk, or calcium cyanamide. Calcium cyanamide should certainly be applied not less than a fortnight before drilling and worked into the land. If applied too near the time of drilling, it will very likely injure the germinating seeds. Sulphate of ammonia, nitrate of lime, nitrate of soda and nitro-chalk may be applied at the time of drilling. The disadvantage of doing this is that very heavy rain may wash some of the nitrate out, while the growth of weeds is encouraged. Alternatively, these fertilizers may be applied in two dressings given after the plants are up, or after singling. Which of these methods is best depends partly on the season and partly on the cleanliness of the land. On heavy land it is usually desirable to apply the nitrogenous manures early to encourage early ripening. When it is desired to lift the crop early on heavy land, it will usually be best to apply all the nitrogenous manures before drilling or very soon after. Under average conditions the total quantity of nitrogenous manures used should be from 2 to 3 cwt. per acre.

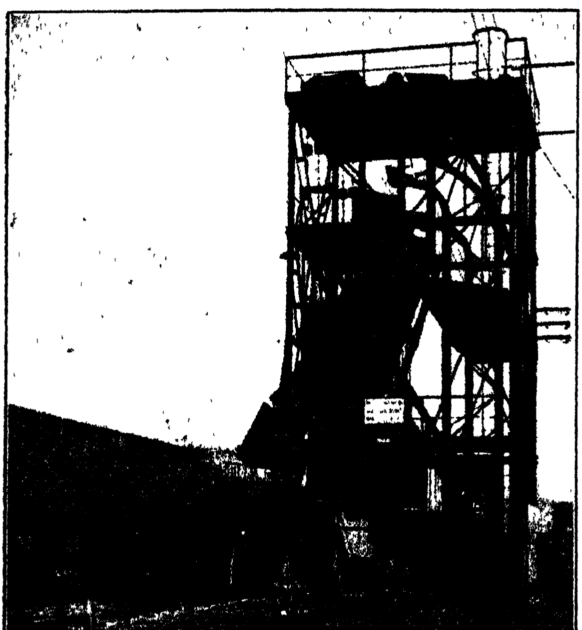
It is useless hoping to grow good crops of sugar beet if the soil is definitely acid. If the soil is acid it is essential that lime, chalk, or some other form of lime should be applied. To obtain a heavy crop it is important to secure a suitable number of roots per acre. For average land, probably about 30,000 is the ideal, but on very light land more are desirable—up to 35,000—while on heavy land excellent yields may be secured with considerably fewer, say, 25,000. Under British conditions, and on most land, probably from 18 to 20 in. may be regarded as the best width between the rows. On light land, and where the land is clean, narrow rows are an advantage ; on heavy land, or where the land is not so clean, they may be wider. The field should be horse-

1 *Journal of the Ministry of Agriculture*, 1920, **37**, No. 1, 6-8.

hoed as soon as this can be done without covering up the small plants. Experiments have shown the importance of early chopping out and singling, and this is now generally recognized. It will undoubtedly pay the grower to exercise very careful supervision over the work of chopping out and singling.

BEET UNLOADING.

Platforms intended for unloading farmers' waggons into railway trucks or silos are costly to construct. Nets of hemp to hold the contents or part of the contents of the waggons may be practicable under American conditions, but their use in Germany, points out G. HRUDKA,[1] has also been found to be too expensive, each costing about 250 RM., or even 350 RM. for the best hemp. A solution, he claims, is to be found in the use of slings consisting of a frame-work of 25-30 wooden lathes, the length of which is about the length of the waggon, these lathes being bound together by wire terminating in rings. Each made in three standard sizes to fit different types of waggons costs about 50 R.M. They are sold to the farmer at half cost, or they may be rented by him at a moderate charge. In use the sling is laid out in the waggon which is loaded up as usual, and driven under the elevator (see the illustration). On arriving there, the sling is attached to the connexions of the elevator, its side pieces are adjusted, and the sling and its load lifted to the top of the shoot, from whence on releasing the connecting chains the load of roots falls into the truck, silo, or other receptacle. About 300 tons per day can thus be unloaded, using four men, and with a consumption of about 24·5 H.P.



OPTIMUM TIME OF LIFTING THE CROP.

Normally our beet factories start their campaign early in October, and there is considerable uncertainty among farmers as to whether deliveries of roots at that time do not prejudice the total weight of sugar. Investigation was therefore undertaken at the suggestion of the Ministry by G. R. CLARKE, L. F. NEWMAN, and A. W. LING[2] at two centres during three seasons, and samples were drawn from selected fields every week during each season. Thus samples of beet grown on the same farm on different soils were examined

1 *Deut. Zuckerind.*, 1930, 55, No. 10, 287-240.
1 *Journal of the Ministry of Agriculture*, 1930, 36, 1159-1166.

through the three years. In each case the samples were taken from a selected area of about one acre.

The results here tabulated, checked by samples grown in the same district, but under different edaphic conditions, show a very fair uniformity and indicate quite clearly that early lifting means a considerable loss in total sugar weight to the grower. They also indicate the end of October as the period of optimum condition of the beet, both in sugar percentage and total crop weight from the farmer's point of view. The loss of plant which may result under unfavourable conditions was also demonstrated, as it may be considered that on light land about 36,000 to 38,000 beets to an acre, varying with the distance apart of the rows, is a full crop. Even under careful conditions of cultivation this maximum was not reached in any of the experimental plots, and in heavy land boulder clay soil only about one-half the theoretical number of beets were actually grown. It must be remembered that on heavy soils beets are usually sown much wider apart than is the case on the lighter soils.

Third Congress of the International Society of Sugar Cane Technologists.[1]

Uniformity in Reporting Factory Data.

F. W. ZERBAN.

The guiding principle which should be followed by the Committee on Uniformity in reporting Factory Data has been well expressed by S. S. PECK, who says: "Your Committee should strive for three main objectives, namely accuracy, clarity, and simplicity; and of these three I consider the last as important as the first two. In striving for greater accuracy, formulas have become so complex that they are practically useless. If the Committee stress simplicity of statement which will not conflict with accuracy and clarity, they may be able to do some persuading to an agreement on terms." Wherever direct determinations can be accurately made, they should be preferred to indirect determinationsor calculations, and practical considerations should be favoured against theoretical speculations.

Weights of cane and mixed juice.—The fundamental equation for the relation between the weights of the materials figuring in the milling control is: Cane + retained added water = mixed juice + bagasse. "Retained water" is used advisedly, because some of the water is lost by evaporation. All the members of the Committee agree that the weight of the cane and that of the mixed juice (as such, or from its volume) should be determined directly, as an accurate, positive control is not possible otherwise.

Weight of bagasse.—Accepting the premise that the weights of cane and of mixed juice have been actually measured, the fundamental equation above still contains two unknown quantities. If we apply the principle of direct determination, postulated above, one of the unknowns must be measured in order to calculate the other. The difficulty of determining the added water actually retained has already been mentioned. It naturally follows that the weight of the bagasse should be determined directly. In Java actual work is being done towards the development of a practical bagasse weigher. However, until such weighing becomes an actuality the weight must be found by indirect means, methods such as the following being in use:—

1 Paper (here a little abridged) published in the Proceedings of the Third Congress of the International Society of Sugar Cane Technologists.

(1) The weight of the imbibition or maceration water is determined and the weight of the bagasse is found by applying the fundamental equation given above (Argentina, Cuba, Java, Louisiana, Mauritius, Natal, Peru and Porto Rico). (2) The fibre % cane is directly determined in samples of cane, and the bagasse % cane calculated from fibre % cane and fibre % bagasse, the imbibition or maceration water % cane being then derived from the fundamental equation (Australia, Hawaii, India, Japan and the Philippines). (3) The fibre % first mill bagasse is found from the analysis of this bagasse (moisture and Brix determined directly); the weight of primary juice is calculated from the Brix of mixed, primary and secondary juices; finally the fibre % cane is calculated from the fibre % first mill bagasse, weight of primary juice, and weight of cane, the weight of bagasse being then found as in the second method. (4) The fibre % cane is found from the weight of mixed juice, using DEERR's formula[1] and a "milling factor" (ratio between Brix of absolute juice and of first expressed juice) of 0·975, the weight of bagasse being then calculated as in the second method.

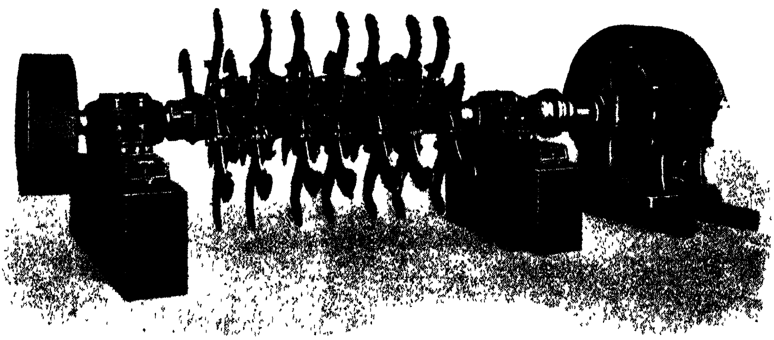
DEERR's method (4) used in India, and also in Porto Rico, assumes a milling factor of 0·975, but it is neither necessary nor advisable to depend on a milling factor at all, except where the weight of mixed juice or of cane is unknown. Method (3) has the advantage over the direct determination of fibre % cane that it assures a better and more reliable sample of material for fibre determinations, but when different varieties of cane are ground together much of this advantage is lost; further, since the weight of primary juice must also be determined directly or calculated, the method is too cumbersome. This then leaves either the direct determination of the weight of the imbibition water (1), or the direct determination of fibre % cane (2). Both are also open to serious objections. The first assumes all the water weighed or measured to be actually retained by the mixed juice and bagasse, but there is undoubtedly loss by evaporation, especially when hot water is used. On the other hand, water which has not been weighed or measured often finds its way into the mill, accidentally or even intentionally. The direct determination of fibre % cane is objected to on account of the difficulty of sampling. A few stalks of cane are rarely representative of a load of cane. It will, therefore, be readily seen that the only positive way of finding the weight of bagasse accurately is that of direct weighing.

Juice figures.—Originally the juice assumed as actually existing in the cane was called "normal juice"; but in some countries (notably Argentina, Cuba, Louisiana, Mauritius and Peru) it is now taken to be the juice extracted by dry milling, leaving out of consideration the juice left in the bagasse, while in others it includes this residual juice. This in itself has led to a great deal of confusion. But the principal difficulty in defining normal juice has perhaps been the fact generally acknowledged that the cane contains not only juice proper (which in the living cane is not homogeneous), but also water loosely held by the fibre. A part of this water is mixed with the actual juice during the milling process, the more the heavier the pressure. On the basis of practical considerations, as well as for the sake of simplicity, it seems best to ignore the undetermined water entirely for the purposes of the milling control, and to consider the juice in the cane under dry milling conditions to be simply cane minus dry fibre. Such a definition has already been adopted in Hawaii, India, Japan, Philippines, and Porto Rico, and the Committee members in the British West Indies, Cuba, Louisiana, and Natal have likewise voted in

1 "Cane Sugar," NOËL DEERR, p. 553.

FARREL

Farrel Revolving Cane Knives



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favour of this definition. It is recommended that the concept of absolute juice defined as cane minus fibre be adopted, because (besides other reasons) it makes it possible to use a simple system of milling control in which it is necessary to know only the weights of cane, of mixed juice, and of bagasse (determined directly, or calculated from the weight of maceration water, or from fibre % cane), and the composition of the mixed juice and of the bagasse. It removes entirely the "milling factor."

Composition of the Bagasse.—At present it is the usual custom to determine only dry substance and polarization in bagasse; and to calculate the Brix and fibre, the Brix determination being based on the purity of the last expressed or last mill juice. But recent investigations of Khainovsky and Egeter have shown that the purity of the juice in the bagasse differs from that of the last mill juice, and that the purity of the juice in the unbroken cells is extremely low. This goes to show that a practical method for the determination of the Brix in bagasse should be worked out; with the Brix accurately known the fibre may be calculated, but until that is accomplished it will of course be necessary to retain the old method in which the purity of the residual juice is taken to be equal to that of the last expressed or last mill juice. However, it should be always kept in mind that this method is only a necessary evil.

Pol. or Sucrose Extraction.—In most countries this figure is based on pol. in mixed juice and in cane, though in some actual sucrose by double polarization is used (or proposed) alongside. While it is true that the extraction figure is not greatly different, whether based on pol. or sucrose, it must be considered that in boiling-house control the *s-j-m* formula of DEERR, which is undoubtedly the most logical one for the calculation of available sugar, holds only when Clerget values are used. A determined attempt should be made to introduce a practical and reliable Clerget method into both the milling and boiling-house control.

Java and Natal ratios.—The Java ratio denotes the relation between the pol. % cane and the pol. of the first expressed juice, and varies with the conditions under which samples of this juice are obtained. It cannot be used for comparisons between different mills, and is of little value, except to discover gross errors in weighing or analysis. Natal, which has experienced the same difficulty as Hawaii when wet cane is being milled, has tried to overcome the defects of the Java ratio by taking the purity of the crusher juice, the Brix of the "last premaceration juice," and using the product of the two, divided by 100, instead of the pol. of the first expressed juice. There is no great need for the adoption of either ratio, but there can be no objection to their use by individual factories or individual countries.

Extraction ratio.—The pol. or sucrose extraction is now universally used to convey some idea of the milling results obtained. W. E. CROSS recommends the "sucrose loss quotient," which is 100 minus extraction. It is generally admitted that the milling performance cannot be expressed by a single figure, and that at best several have to be used in conjunction. In Hawaii the financial result has during the past 15 years or so been expressed by the ratio of unextracted sucrose of the fibre % cane, or (100 — sucrose extraction) divided by fibre % cane. This is termed the "extraction ratio," and has proved very useful. It is also recommended by P. HONIG, and until a better but still simple expression can be devised it should be adopted.

Milling Loss.—This factor, used to express the technical rather than the financial result of milling, is the percentage ratio between polarization %

bagasse and fibre % bagasse. It is used in Hawaii and the Philippines, and is favoured by the members from the British West Indies, Louisiana and Mauritius. In Java the undiluted juice in bagasse, instead of the polarization in bagasse, is employed in calculating the milling loss ; but this figure, also endorsed by Porto Rico, is again based on the Brix of the primary juice. In Natal a further ratio has been introduced, the so-called Lely ratio, which is the milling loss, as understood in Hawaii, multiplied by 100/sucrose % normal juice. It is contended by Natal and by Porto Rico that this figure is more useful than the milling loss (Hawaii) when comparing extraction from canes of widely varying sucrose content. Of the three methods in use, the milling loss as calculated in Hawaii is the one most widely favoured. In Java the undiluted juice in first mill bagasse % fibre, and that in final bagasse % fibre, are expressed in per cent. of the same figure which should "normally" be obtained in the same type of mill train, which normal values are found from tables. NOËL DEERR has devised an elaborate system of calculations, lately adopted in India, which gives the efficiency of the separate milling processes on the basis of what would be obtained under "ideal" conditions. The efficiency of imbibition or maceration is included in DEERR's system ; and other formulas for calculating it have recently been proposed by PECK,[1] and by COPP.[2] In view of the desirability of having any international methods as simple as possible, it is recommended that for the present only the extraction ratio, the milling loss, and the undiluted juice in bagasse % fibre, be adopted, all of which are simple to calculate from data determined everywhere.

Mechanical Mill Data.—Hawaii, Java, and lately also Argentina, report type of milling equipment, roller dimensions, mill openings, speed of rollers, pressure on rollers, and similar data. It is very desirable that such information be made available by all other countries also, in order to facilitate comparisons.

Mill Capacity Figures.—In Hawaii the "tonnage fibre ratio," which is the "tonnage ratio" multipled by the fibre % cane, is now used. The "tonnage ratio" is the tons of cane ground per day, divided by the tonnage ratio factor ; and the latter equals $\frac{1}{6}$ times the square of the length of the rollers in feet, times the number of units in train. The member from Hawaii states that the tonnage ratio favours short rollers a little too much ; and the member from Natal remarks that the diameter of the rollers should also be taken into account. The "grinding coefficient," employed in Cuba, and favoured in Louisiana and Porto Rico, is calculated on a somewhat different basis, and does consider the diameter of the rollers. It equals tons of cane ground per hour, divided by the product of the total number of rollers, times length of rollers in feet, times diameter of rollers in inches. PECK has pointed out that the tonnage fibre ratio alone is not sufficient to give an adequate idea of the mechanical mill performance, and that the tons fibre per lineal foot per hour should also be reported. In Java three figures are used which roughly correspond to tonnage ratio, fibre ratio, and the figure proposed by PECK. W. E. CROSS favours a figure based on the kilos of dry fibre crushed per sq. meter of crushing surface per hour in the first mill ; but he criticizes the fact that the number of mills in the train is not taken into account. None, however, of these expressions showing mechanical milling performance is widely used ; and under the circumstances it is best to recommend a further study of this phase of milling control.

1 *I.S.J.*, 1927, 254. 2 *Facts about Sugar*, 1928, 350.

Publications Received.

Traité de Polarimetrie. Georges Bruhat. With a preface by Prof. A. Cotton, Member of the Institute. (Revue d'Optique, théorique et instrumentale, Paris.) 1930. Price : 65 fr.

Regarding those parts of this work of more direct interest to chemists concerned with the application of the polarimeter in sugar analysis, one draws attention to the *notions générales* of the polarization of light, to the review tracing the evolution of the polariscope, and to the account of polarimeters. These sections are well done, and the historical aspect receives due consideration in them. Saccharimeters are given only about 14 pages, it is true, though the account in that comparatively brief space presents essential theoretical and practical information. Writing of the saccharimeter compensator, the author emphasizes the great necessity of the optical purity of the quartz. Of 50 pieces which may be perfectly transparent there may be only one satisfactory for use in the construction of the compensator. One sees here the importance of great care and experience on the part of the saccharimeter constructor, if the proper precision of the instrument is to be realized. Another point made refers to the adjustable sensitivity by the variation of the half-shadow angle : "Il est de se priver de l'advantage de pouvoir obtenir dans chaque cas la sensibilité maximum compatible avec la transparence de la solution étudiée." He refers to the manner in which this is accomplished by BATES in the saccharimeter constructed by FRIC, and also in the excellent instrument made by JOBIN, which, we remark, seems to be insufficiently well-known outside France. In the second part of the book dealing with polarimetric determinations, there is a good summary of data on different scales, and on corrections for temperature, light and concentration, which should serve the student well. Dealing with double polarization, we are told that generally in France the mode of operating proposed by CLERGET in 1849 is still followed, although with the use of the appropriate divisor according to the concentration. Invertase is too slow in its action for routine work, it is pointed out; but one would like the author to have given an account of acid methods designed to give the same accurate results as are obtained with invertase. As a whole this book presents a fairly complete account of the principles and practice of polarimetry, and is well arranged for the use of the student with its indexes of subjects and names, and especially its extensive bibliography, which gives no fewer than 882 references.

Alcoholometry: An Account of the British Method of Alcoholic Strength Determination. By Francis G. H. Tate; with an historical introduction by the author in collaboration with George H. Gabb. (H.M. Stationery Office, London). 1930. Price : 5s. net.

An account is given of the evolution of the Sikes hydrometer, this being "the first published account of the British system embodying a documented record of SIKES's work and theories based on his own note-books." This together with reproductions of apparatus and manuscript makes the book an interesting one historically. The prototype of the Sikes instrument was the "brandy prover" of JOHN CLARKE, a "Turner and Engine Maker" of York, whose improved design (in brass) of about 1725 was constructed with no fewer than 140 weights. SIKES's scale was based on the manner in which spirit impregnated in gunpowder burned, being "over-proof" if combustion took place with some explosive violence, or "under proof" if burning were difficult or impossible, and "proof" if the mixture burned steadily. SIKES's scale as adopted for British Excise purposes has been the object of very frequently repeated criticisms as being unscientific and complicated, and more rational systems founded on density and actual alcohol percentage have from time to time been proposed by authorities. However, it remains the official method in this country. As a record of SIKES's system, this monograph can be well recommended. It is well written and illustrated, and apart from its historical aspect it contains much information that should prove useful to those concerned with the problem of the determination of alcoholic strength.

Sugar Charts. We have received the following charts, dealing with Prices and Quantities on the Sugar Market, which are suitable for framing, and will be found useful for those making a close study of market conditions. These charts are complimentary, and those desiring copies should apply to the firms concerned.

(*a*) CHART SHOWING MOVEMENTS IN THE LONDON, NEW YORK AND CANADIAN SUGAR MARKETS, 1926-29; London Raw Terminal Market, Basis 96° Sugars c.i.f. U.K./Continent, and B.W.I. Sugars Basis 96° Parity c.i.f. Canadian Atlantic Port; New York Sugar Exchange and Basis 96° Sugars c. & f. New York. This is a useful Chart of prices issued by Messrs. CZARNIKOW LTD., Mincing Lane, London.,

(*b*) CHART SHOWING THE IMPORTS OF REFINED SUGAR, RAW SUGAR, TOTAL OF ALL KINDS; IMPORT PER HEAD OF POPULATION AND PERCENTAGE OF IMPORTS OF FOREIGN REFINED, EACH YEAR; THE HIGHEST AND LOWEST PRICES OF TATE'S CUBES DUTY PAID, AND 88 PER CENT. RAW BEET (F.O.B.) AND 96° CENTRIFUGALS (C.I.F., U.K.) AND ALTERATIONS IN SUGAR DUTIES; 1860 TO 1929 INCLUSIVE. This is an annual Chart, issued by Messrs. TATE & LYLE LTD., the well known London and Liverpool sugar refiners.

(*c*) SUGAR CHART FOR 1929: showing Daily Prices of London Terminal Raw Sugar Market (Morning Call Prices), basis 88 per cent. Beet delivered f.o.b. Continental Ports; New York Coffee and Sugar Exchange (Closing Prices), basis 96° Centrifugals, ex Licensed Warehouse, New York; Refined Sugar, Duty Paid and 96° Centrifugals, c.i.f., U.K.; etc. This Chart is issued by M. GOLODETZ, of 117a, Fenchurch Street, London, E.C.3.

Kuba, Haiti und Louisiana als Zuckerländer (Cuba, Haiti and Louisiana as Sugar Producers). Impressions of a journey of investigation through these countries. By Dr. Gustav Mikusch. With 6 Maps, 12 Illustrations and 26 Tables. (Verlagsbuchhandlung Paul Parey, Berlin, S.W.11.). Price: Paper Covers, Rm. 16·50; Bound in Cloth Rm. 19.

Following on an invitation of the Cuba sugar industry, the well known Vienna sugar expert, Dr. G. MIKUSCH, undertook a tour of investigation in 1928 in Cuba, Haiti, and Louisiana sugar belts, and this volume in German is an account of his impressions. The larger part of the work is devoted to the sugar industry of Cuba, production and cultivation in that island being described with some detail and reference being made to the latest researches on cane breeding, and on pest control. In a second section the sugar industry of Haiti is dealt with, and in a third that of Louisiana and Florida, which are at present experiencing a period of remarkable advance. A detailed index completes the volume.

S. A. Sugar Year Book and General Directory, 1930. A Reference Book and Guide to the Sugar Industry of South Africa. Demi octavo, 320 pages. Illustrated. (*S.A. Sugar Journal* Offices, Durban). 3s. post free.

This is the first issue of a new Year Book and Directory supplying all the essential details relating to the various phases of the cane sugar industry in South Africa, and is compiled by Mr. H. O. ANDREWS, Editor of the *South African Sugar Journal*. It will be found of considerable utility to all those wishing to possess all the details of that industry, commercial, statistical and technical.

Optical Rotation and Ring Structure in the Sugar Group. H. S. Isbell. Research Paper No. 128; Bureau of Standards. (Superintendent of Documents, Washington, U.S.A.). 1930. Price: 5 cents.

Contents: Determination of ring structure; calculation of the numerical value for the optical rotary power of the various asymmetric carbon atoms; comparison of the rotations of the methyl glycosides with the rotations of the sugars; and the prediction of values for the rotation of unknown sugars and glycosides.

Review of Current Technical Literature.[1]

IMPROVEMENTS IN FACTORY CONTROL IN PORTO RICO. **E. M. Copp.** *Paper presented to the Association of Sugar Technologists of Porto Rico,* 1930.

Now it cannot be denied that the average mill work at some of the factories in Porto Rico prior to 1923 was anything but satisfactory and when the introduction of the Petree process had centered attention on mill work, a number of our chemists had already realized that much of the control data was unfit for purposes of comparison and that among these the two most important items were the imbibition and the brix of the absolute juice. Plazuela was the first factory to use scales for weighing the imbibition water. Fajardo, Canovanas, and Monserrate installed water scales last year, and Mercedita follows this year. Others have adopted methods of calculating the imbibition data that approximate closely the values obtained by measurement, and it is a pleasure to know that much of the mill work now reported can be accepted as being both reliable and comparable. Table 1 shows to what extent some of the larger factories are reporting apparent errors in their imbibition figures. Many of the factories were employing various schemes of juice and imbibition flow. In their system there is but one basic flow for the imbibition juices and one place at which the water should be applied. It is called straight compound imbibition and is the mathematically logical system; it is also the most efficient one for the Petree process. We require its use either in its simplest form or one of the modified forms that are needed to meet special conditions of high grinding rate or long tandems (of five or more units.)

In view of the fact that in the ultimate analysis the object of milling and imbibition is the separation of the juice from the fibre, the relative efficiency of mill work is best expressed by the " Lost Juice " figure, which has for some time been in general use in Java, and which represents the undiluted juice in bagasse per cent. fibre.[2] In determining the undiluted juice in bagasse all uncertain data are disregarded; i.e., weight of bagasse, weight of imbibition water, relation between imbibition and dilution, absolute brix factor, unaccounted water entering the juice, fibre in cane, etc. Only four items of analytical data are needed, viz. : Polarization per cent. bagasse, moisture per cent. bagasse, brix of crusher juice, and purity of residual juice ; all of which are determined in the laboratory and do not depend on more or less arbitrary assumptions. No other factor, except tonnage, has to be taken into account before the mill work can be judged, whereas, in comparing sucrose extractions, the polarization in cane, fibre in cane, and purity of residual juice must be taken into consideration before the true mill work can be estimated. The " Lost Juice " figure is not influenced in any way by the weighing of clarified instead of cold raw juice nor by returning the settlings to the mill. Table I shows to what extent the mill work has been improved ; and also shows the extraction figures.

TABLE I.

	Undiluted Juice in Bagasse per cent. Fibre.		Sucrose Extraction.	
	1923-24	1929	1923-24	1929
Factory A	42·03	34·50	94·67	96·01
Factory B	46·53	22·52	93·49	97·15
Factory C	53·64	42·79	93·43	93·34
Factory D	34·93	33·47	95·73	95·62
Factory E	58·94	29·12	91·60	95·44
Average	47·21	32·48		
Reduced loss in bagasse		31%		
Factory F	49·30	32·45	93·59	95·74
Factory G	61·51	39·69	92·92	94·11
Factory H	37·51	39·00	95·50	94·62
Factory I	49·53	36·64	94·09	94·71
Average	49·46	36·95		
Reduced loss in bagasse		25%		

2 *I.S.J.*, 1929, 642.

These figures indicate that reported improvements in sucrose extractions are not proportionate to the mill efficiencies as judged by the lost juice figure; for instance, while Factories C, D, and I showed very little change in sucrose extraction, the lost juice figures indicate a distinct improvement in mill work. It has been recommended that Cuba adopt the lost juice figure[1] and it will soon become a familiar figure in Porto Rican data. Fajardo has been using it for some time, in a slightly modified form, and is now reporting the standard figure. In order to be able properly to evaluate the above comparisons, it is necessary to know the tonnage of cane ground, which is shown in Table II :—

TABLE II.

Tons Cane Per Hour per Tandem.

	1923-24		1929
Factory A	59·06	..	65·35
Factory B	44·33	..	49·00
Factory C	52·22	..	59·11
Factory D	39·79	..	74·01
Factory E	43·40	..	86·17
Average	47·76	..	7·0·73
Average increase			48%
Factory F	58·13	..	71·31
Factory G	53·93	..	72·90
Factory H	57·30	..	60·40
Factory I	52·13	..	89·26
Average	55·37	..	73·47
Average increase			33%

The figures in this table show how greatly the mill efficiencies have been improved for, along with an average increase of 36 per cent. in tonnage, there has been an average decrease in lost juice of over 28 per cent. Of all of the above factories only two have added new mill units during the five years: Factory E and Factory F. Factory E has increased from 12 rolls to 18 rolls, and F has increased from 12 rolls to 15 rolls. All of the factories, except C, H and I, use knives in front of the crusher.

THE "CELOTEX" (BAGASSE BOARDING) INDUSTRY. **Elbert C. Lathrop.** *Ind. & Eng. Chem.*, 1930, **22**, No. 5, 449-460.

In 1920 there was enough bagasse produced annually in Louisiana, this article says, to manufacture one billion sq. ft. of "Celotex"; but in 1923 just as the production of this boarding was getting well under way it began to appear that the Louisiana sugar industry was failing. Dr. E. W. BRANDES reported that this was due to the canes grown in that state becoming so weakened that they could no longer continue to withstand the rigours of weather and disease. His remedy was to plant POJ canes, and A. H. ROSENFELD, consultant to the American Sugar Cane League, came to the same conclusion. By 1926 the average yield of cane was 6·7 tons per acre, and planters were disheartened and financially crippled. At this juncture a financing group was organized, the Celotex Co. feeling that only by such a step could the industry be saved. Loans were made to the planters on the understanding that the new POJ canes be planted, and the recommendations of BRANDES and ROSENFELD as to cultivation be followed. In 1927 the areas planted with these canes gave about 20 tons per acre, and in 1929 about 250,000 tons of cane was grown in Louisiana. Then in 1927 B. G. DAHLBERG organized the South Coast Co., owning about 50,000 acres and five mills in Louisiana. In 1926 he had also formed the Southern Sugar Co., which to-day owns or controls about 170,000 acres of the Everglades lands, Florida, one-third of which is under complete water control. This concern operates at Clewiston a mill of 4000 tons of cane per day, which is equipped with the most modern improvements, and is the largest cane factory in the U.S. It is expected

[1] E. L. SYMES in *I.S.J.*, 1929, 591.

to produce annually at least 500,000 tons of sugar on these Florida properties. When their present project is completed, the Dahlberg industries will control annually about 1 million tons of dry cellulose as bagasse.

The plant at Marrero, La., in 1922 produced 18·9 million sq. ft. of the boarding; 54·9 in 1924; 190 in 1926; and 260·6 in 1928; while the estimated production for 1930 is 460. "A study of this record shows that the optimistic figures given by some agencies are far from being reached. Further a considerable portion of the footage shown as sold during the past few years did not go into construction industries. It was used for industrial purposes, where the manufacturing problems are considerably more serious than for construction materials owing to fabrication, or was exported overseas. This potential market, which is believed by all serious students to be very large will therefore be reached only by education and sound merchandising." The rest of this long article is given to describing the method of purchasing the bagasse; its baling, storage, transportation, and preservation. An account is given of the process of manufacture at Marrero, which includes the following stages: Cooking, washing, waterproofing, boarding, drying, seasoning and sawing. At first only standard building board was manufactured, but now in addition to this the major products are: lath, various types of insulation, carpet lining, linoleum base, absorption base, core stock, radio baffles, and "Acousti" Celotex. The article concludes by stating: "This industrial group now conceives the sugar industry as one either devoid of by-products or made up only of by-products. The securing of fibre and sugar is being thought of, not in terms of agriculture, sugar milling, fibre manufacture, but as a continuous inter-related and interlocking industrial problem, beginning with the drainage and character of the soil, and ending with the finished fabricated article in the hands of the customer."

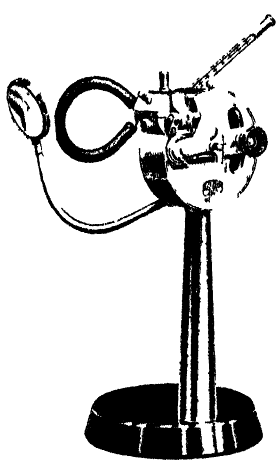
VALLEZ FILTERS IN SUGAR REFINING. **A. C. Nielsen Company**, Industrial Surveyors; in collaboration with **Frank L. Harvey**, Experimental Superintendent, Pennsylvania Sugar Company, Philadelphia.

Formerly the Philadelphia refinery used a filter plant consisting of canvas leaves mounted on a non-rotating vertical shaft enclosed in a vertical tank. The canvas cloths were coated with "Hyflo" filtering medium and the filtrate passed through this material and the cloths into the interior of the leaves and was drained off by small pipes projecting through the wall of the tank; 16 filters were used for washed sugar and re-melt sugar liquor and the units could be operated only from one to two hours before requiring cleaning. Sweetening-off could not be done on the leaves, it being necessary to dump the medium to the bottom of the tank after a run and recover the sugar therein with a water-wash. Presence of solids in this sweet-water required its filtering in five additional filters so that there were 21 units in all. About 6 lbs. of "Hyflo" were required per ton of sugar produced. Canvas required replacement every 20 to 30 days, the cost of each being about 75 cents for cloth and 25 cents for rivets, gaskets, threads and other supplies. An 11-man crew was required for filter maintenance, 5 men to cover the leaf frames with new canvas, and 6 men to install and remove frames from the filters. Screened washed-sugar liquor is now filtered in 8 Vallez filters and the re-melt sugar liquor is handled in four additional units. Before filtering, the leaves are coated with a filtering medium. Wood pulp was tried for this purpose, but "Hyflo" is now used exclusively because of greater simplicity in handling and recovery. The medium is deposited by passing a suspension of "Hyflo" through the filter for about 15 minutes, resulting in a $\frac{1}{8}$ in. coating over the monel metal filter cloth. In filtering, the liquor is pumped through the filter under 30 lb. pressure and back to the storage tank and is thus continuously circulated until the filtrate shows clear, requiring eight to ten minutes, after which it is pumped to the char-filter supply.

The plant has a capacity of about 4,000,000 lbs. of sugar daily and the average output is 3,000,000 lbs., so that about 750,000 gallons of 54° Brix washed-sugar liquor passes daily through the 8 filters used for that purpose. Sweetening-off, preceding cleaning, is accomplished while the "Hyflo" is still on the leaves by simply running clear water through the filter, so that no extra filters are required for filtering

sweet-water after dumping the cake, as was necessary with the canvas filters. Three men are required for the maintenance of the twelve Vallez filters as compared with an 11-man crew needed for the canvas filters. With regard to repair and maintenance, replacement cost of the 40 coarse wire screens, eighty perforated plates and eighty monel metal screens in each filter are based on the estimated lengths of service stated below. Maintenance cost of the former filters includes 12 replacements yearly of the 96 canvas filters in each of the 21 units. After including allowance for miscellaneous repairs the annual fixed charges total $42,375 for the former filters and $17,195·88 for the Vallez units, and when pro-rated to a daily basis amount to $154·09 and $62·53 respectively. In comparing daily operating costs it is found that the present battery requires 2·6 tons of filtering medium daily as compared with 4 tons for the former filters. Power costs for the present units are shown. Labour costs cover 10 operators and 11 maintenance men for the former equipment as compared with 5 operators and 3 maintenance men for the Vallez filters. The total daily operating cost of canvas-type filters is $564·09 as compared with $318·53 for the Vallez units. Based on average daily production the filtering cost per 1000 lbs. of sugar produced is $188 and $106 respectively. Following are shown the operating costs of the battery of 12 Vallez filters in comparison with the 21 canvas filters formerly used for the same volume of filtering. Depreciation and average interest on both types are based on a 20-year life.

General Data.	Former Filters.		Vallez Filters.
Daily production, M. lb. average	3,000	..	3,000
Number of filters	21	..	12
Investment per filter	$10,000·00	..	$11,000·00
Total investment	$210,000·00	..	$132,000·00
Annual Fixed Charges :—			
Depreciation 20 yr. life	$10,500·00	..	$6,600·00
Average interest at 6 per cent..............	6,615·00	..	4,185·00
Repair and maintenance wire screens (40 × 12 × $7·00 × 3) divided 20 yr.	—	..	504,00
Perforated plates (80 × 12 × $17·78 × 2) divided 20 yr.	—	..	1,706·88
Monel metal screens (80 × 12 × $25·00 × 3) divided 20 yr.	—	..	3,600·00
Canvases 96 × 21 filters × 12 changes × $1.00	24,192·00	..	—
Miscellaneous repairs $50·00 filter	1,050·00	..	600·00
Totals..............................	$42,375·00	..	$17,195·88
Daily Operating Costs fixed charge 275 days..	$154·09	..	$62·53
Filtering medium 4 and 2·6 T. at $50.00/T. ..	200·00	..	130·00
Power 50 k.w. × 24 hr. × $·03 k.w. hr.....	—	..	36·00
Labour—			
Operating :—			
10 men × 24 hr. × $60/hr.	144,00	..	—
5 men × 24 hr. × $0·60 per hr.	—	..	72·00
Maintenance :—			
11 men × 10 hr. × $0·60 per hr.........	66·00	..	—
3 men × 10 hr. × $0·60 per hr.	—	..	18·00
Totals.............................	$564·09	..	$318·53
Unit Cost—			
Per N lb., sugar 3,000 M.lb. daily	$0·188	..	$0·106
Saving—			
Per M lb. sugar $·188—$·106	—	..	$·082
Per day $564·09—$318·53	—	..	$245·56
Per year $245·56 × 275 days	—	..	$67,527·00
Annual return on investment	—	..	51%



Thus a comparison for the figures shows that the Vallez filters are effecting a saving of $0·082 per one thousand lb. of sugar produced in filtering costs. An examination of the detailed costs in the accompanying table will indicate that the major portion of this is due to the use of monel metal screens instead of canvas for bearing the filtering medium ; credit for this economy must be shared between the design of the filter and the durability of that metal. Further calculations show that the saving is at the rate of $245·56 daily or $67,527·00 yearly, representing an annual return on the investment of 51 per cent.

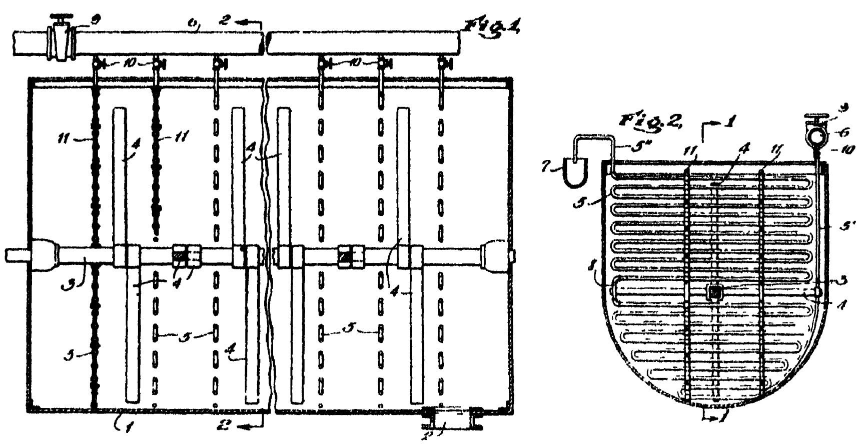
CENTRIFUGAL PUMPS FOR SUGAR JUICES. **R. W. Miller.** *Facts about Sugar*, 1930, **23**, No. 13, 317. In electrically-driven factories, high-speed centrifugal pumps are being adopted, thus effecting considerable economy of space, as well as initial cost. In Java, for example, the Lutzer modification of the fresh water pump has found favour. All parts coming into contact with the juice are made of special bronze, and as a result of the special design of the impeller any sand, *bagacillo*, etc., can pass through without difficulty. Such pumps are designed for handling the raw juice, using a coarse strainer to arrest the larger fibre particles, as well as sulphited juices. They are used also for thick-juice (or evaporator syrup) the steady pressure given by this type of pump being advantageous at the filter-presses.—SEMI-COMMERCIAL PRODUCTION OF XYLOSE. **W. T. Schreiber** and others. *Ind. & Eng. Chem.*, 1930, **22**, No. 5, 497-501. An account is given of the operation of the Anniston plant of the Swann Corporation on the production of xylose (wood sugar) from cotton-seed-hull bran. Steps in the process consist of : Removal of gums, ash, etc., by digestion with hot water under pressure, and washing , extraction of the xylan from this purified bran ; hydrolysis of the xylan to xylose by hydrolysis with sulphuric acid ; and concentration. Per 100 lbs. of the raw material mentioned, it was possible to obtain 13 lbs. of crystalline xylose and 16 lbs. of mother-liquor, containing 8 lbs. of xylose, the best method for the recovery of which residue is now being investigated. Cost of producing the crystalline xylose is 2·234 cents per lb., and of the mother-liquor, 1·072 cents per lb., this for heat, power, water, sulphuric acid, and lime, but not labour, overhead, depreciation and cost of raw material.—INSULATING BOARD FROM STRAW (BAGASSE AND THE LIKE). **Albert G. Gibson.** *Ind. & Eng. Chem.*, 1930, **22**, No. 3, 223-226. In 1927 a new venture in the utilization of straw was launched on the plant scale at St. Joseph, Mo., U.S.A., for the Stewart Inso Board Co., and 30,000 tons of straw was converted during 1928 into a board similar in properties to that manufactured from wood waste or bagasse. An outline of the processes of cleaning, cutting, digestion, disintegration, beating, boarding and drying are given (with four illustrations). As the board is leaving the dryers, it is sprayed with furfural and resinous substances derived from the original straw, in order to preserve, bind, and render it relatively moisture-proof. This board is finding ready application as a heat and sound insulating material.—ABSORPTION OF ATMOSPHERIC OXYGEN BY LIMED CANE JUICE. **J. A. Ambler.** *Ind. & Eng. Chem.*, 1930, **22**, No. 4, 357-362. Oxygen is absorbed by cold limed cane juices, with the formation of acidic products which cause a decrease in the alkalinity of the limed juices. The amount of oxygen absorbed is greater with high than with low percentages of lime. By plotting the volume of oxygen taken up against the duration of time, characteristic curves are obtained which show rapid absorption at first, followed by slower absorption. The rapid initial absorption is caused by a non-sugar which is removed by neutral lead acetate but not by lead nitrate. Solutions of invert sugar give curves which indicate slow initial absorption, and which are of the same character as those of the lead acetate treated juice. The solution of a mixture of invert sugar with a small amount of tannic acid gives curves which have the same characteristics as those given by both the original juice and the juice after treatment with lead nitrate. The tannins and polyphenols of the juice are the chief absorbents of oxygen and the decrease of alkalinity in limed juices is due in part to the formation of acidic oxidation products of both the tannins and invert sugar. J. P. O.

Review of Recent Patents.[1]

UNITED STATES.

Crystallizer. **Ernst W. Kopke** (assignor to **Frank L. Allen,** of Monclair, N.J., U.S.A.). 1,749,588. serial 161,981, March 4th, 1930.

Crystallizing apparatus of the usual type is employed, comprising a horizontal tank and a massecuite agitator with arms travelling in vertical planes spread regularly apart from one end to the other; but the inventor provides means of cooling the massecuite along vertical planes alternating with the planes of movement of the agitating arms. In Figs. 1 and 2, 1 indicates a tank rectangular in transverse section but having a rounded bottom, provided with a discharge outlet 2. Axially mounted is a horizontal agitator shaft 3 carrying stirrer arms 4 distributed along the length of the shaft. The arms are arranged in sets, each set comprising a pair of arms extending in opposite directions from the shaft and arranged to travel in the same general vertical plane transverse to the shaft when the latter is rotated. The planes of movement of adjacent sets of stirrer arms are separated from one another by a distance of 2 ft. or so. As shown, the arms of the adjacent sets are staggered in the sense that the arms of each set are at right angles to the arms of the other set. The crystallizer shown is of a type in extensive use, though it has heretofore been customary to connect the outer tips of the stirrer arms of the different sets by spiral ribbon-like members. For the purpose of the present invention, the old elements of the crystallizer are combined with the cooling coils 5.



Each is in the form of a pipe bent to form parallel horizontal limbs connected by return bends and disposed at regular spaced apart levels from the top to the bottom of the tank, the lengths of the different limbs being such that each extends at its ends nearly to, but not into contact with the side walls of the tank. Each coil is in effect divided into an upper section above the shaft 3 and a lower section below that shaft, these two sections being connected by a nipple 8. The convolutions are mechanically supported by vertical supports 11 in the form of split bars clamped on the pipe convolutions and resting at their lower ends on the bottom wall of the tank. Also, each cooling coil receives water from a supply pipe 6 and discharges at its other end into a drain pipe or gutter 7 which carries the discharged water to waste, or to a cooling tower or reservoir according to plant requirements. Cooling liquid (water) is supplied from the pipe 6 to the lower end of the coil convolutions through a coil end portion 5 ft. extending upward within the tank and passing out of the tank at its top, and connected above the tank with the pipe 6 through an individual throttle or control

[1] Copies of specifications of patents with their drawings can be obtained on application to the following—*United Kingdom*: Patent Office, Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2 (price 1s. each). Abstracts of United Kingdom patents marked in our Review with a star (*) are reproduced from the *Illustrated Official Journal* (*Patents*), with the permission of the Controller of H.M. Stationery Office, London. Sometimes only the drawing or drawings are so reproduced. *United States*: Commissioner of Patents, Washington, D.C. (price 10 cents each). *France*: L'Imprimerie Nationale, 87, rue Vieille, du Temple, Paris. *Germany*: Patentamt, Berlin, Germany.

valve 10. The discharge end 5 in. of each coil also passes out of the tank at the top of the latter and terminates in a goose neck portion discharging into the gutter 7, which, as shown, is arranged alongside the tank. The aggregate amount of cooling fluid supplied to the different cooling coils 5 may be regulated by a throttle valve 9 in the pipe 6 at the inlet side of its connexions to the coils 5. With a suitable water temperature and pressure and such adjustment of the valves 9 and 10 as may be required, it is possible to have each cooling coil exert any desired massecuite cooling effect. The distribution of the coil cooling effects over planes alternating with the planes of rotation of the stirrer arms 4 permits, in practice, of substantial uniformity in the cooling effects exerted on different portions of the massecuite. Heat may thus be extracted from massecuite, at a rate much more rapid than has heretofore been possible without forming false grain. Also, it is possible to have the process proceed continuously.

Confectionery Manufacture. (*A*) **Oscar E. Segrin** (assignor to **Merrow Bros., Inc.**, of Boston, Mass.). 1,750,865. March 18th, 1930. (*B*) **Jesse W. Greer and Fred. W. Greer**, of Cambridge, Mass. 1,753,828. April 8th, 1930. (*C*) **Alfred G. Rose** (assignor to **Rose Brothers, Gainsborough, Ltd.**, of Gainsborough. 1,758,468. May 13th, 1930. (*D*) **Ronald Head** (assignor to **Baker Perkins Co., Inc.**, of Saginaw, Mich.). 1,758,602. May 13th, 1930.

(*A*) A coating machine comprises side frame members, a storage tank supported between said members, a flow pan, a pair of drums rotatable in vertical planes between said members and each having a portion of its peripheral path dipping within said storage tank and a portion elevated above said flow pan, each of said drums having a rim off-set toward said flow pan and overlapping the adjacent end of said pan, brackets secured to each side frame member and projecting inward over and beyond said offset rims, an arm depending from each of said brackets and having a horizontal aperture, a separate scraper bar slidable in each of said apertures with its operative end positioned within one of said offset rims, and means to secure said bars in adjusted position in said arms, whereby the feed of coating material may be regulated. (*B*) A cooling tunnel for cooling confections, comprising in combination an elongated casing which is closed to the atmosphere and provided with a lower air passage and an upper air passage, means for advancing confections through the casing, blowers arranged near the opposite ends of the tunnel externally of the casing, air conduits between said air passages and blowers for forcing air from one passage to the other and arranged to introduce air into the upper passage and remove it therefrom through the top of the casing, and means for cooling the circulating air. (*C*) In a wrapping machine of the type described operable on a continuous bar of confectionery stock, the combination of a movable carrier, a reciprocating pusher for feeding caramels one at a time, to the carrier, stock feeding mechanism for feeding a bar of stock up to a cutting station which is located at a point offset laterally from the path of the charging pusher, a cutter for effecting wholly at the station aforesaid the entire operation of severing individual caramels from the bar, and transfer mechanism separate from the cutter to convey the caramels one at a time from the cutting station through an accurate path which is a quadrant of a circle into the path of the pusher. (*D*) A continuous method of preparing cream fondant, comprises the steps of continuously cooking and then cooling sugar syrup ; subjecting the cooled syrup to a partial heating action ; continuously adding to the partially-heated syrup a predetermined proportion of uncooled, unheated diluting syrup which, at the time of its addition, is hotter than the mass whereto it is added ; and then subjecting the fondant mass and added syrup to further beating.

Treatment of Comminuted Carbonaceous Material in Electric Furnaces (Activation of Carbon)[1]. **John J. Naugle**, of Brooklyn, New York. **1,731,474. October 15th, 1929.**

[1] See U.K. Patents, 267,240 and 267,241 ; *I.S.J.*, 1927, 337.

RIPENING SUGAR CANE IN SUB-TROPICAL COUNTRIES. **Denis P. J. Burguieres,** of Louisa, La. 1,746,190. February 4th, 1930. Claim is made for the method of ripening sugar cane which consists in spraying over the tops of the still growing plants finely divided unslaked lime, thereby artificially checking the growth thereof.—CRYSTALLIZATION. **Ernst W. Kopke,** of New York (assignor to **Frank L. Allen,** of Montclair, N.J.) 1,749,588. March 4th, 1930. A method of treating massecuites consists in establishing a plurality of similar temperature modifying effects in a series of planes, and passing the massecuites through substantially the entire area of said planes, to produce a uniform temperature modification of the entire mass. —EVAPORATOR. **William Sieck, Jr.** (assignor to **William Garrigue & Co.,** of Chicago, Ill.). 1,750,434. March 11th, 1930. This evaporator embodies an elongated and inclined chamber, heating tubes therein and extending throughout the length of the chamber, means for supplying a heating medium into the tubes, means for supplying liquid into the chamber, said tubes being so arranged in the chamber as to cause the liquid to flow against only so much of the heating surfaces as is necessary to convert said liquid into vapour, and means for creating a defined circulation of the liquid within said chamber.—DEXTROSE MANUFACTURE. **William B. Newkirk** (assignor to the **International Patents Development Co.,** of Wilmington, Del.). (*A*) 1,750,938. (*B*) 1,750,939. March 18th, 1930. (*A*) Method of making crystalline dextrose hydrate comprises incompletely melting the solid hydrate dextrose having a purity above ninety per cent. so as to leave some of the substance of the solid phase, and inducing crystallization of hydrate dextrose by supersaturation without the addition of seed crystals and with the magma in motion. (*B*) Method of making dextrose comprises incompletely melting the impure solid or semi-solid dextrose of substantially one crystal type and bringing about supersaturation of the solution so formed to induce crystallization of the dextrose in solution in the form of crystals of the type of the unmelted dextrose.—ULTRA FINE, SOFT GRANULATED SUGAR. **Bernard H. Varnau and Truman B. Wayne,** of Sugar Land, Texas. 1,751,298. March 18th, 1930. Claim 1 : Granulated sucrose sugar consisting of ultra fine, soft, substantially uniform crystals substantially free from adhering syrup. ANHYDROUS ALCOHOL PRODUCTION. **Ovidio Leonori,** of Narni, Italy. 1,751,211. March 18th, 1930. A process of producing anhydrous alcohol to be used principally in the preparation of fuels and solvent consists in treating aqueous alcohol with a mixture of metallic carbides decomposable by water, and hydrides of calcium and aluminium.—DEFECATION OF CANE JUICE **Arthur W. Bull** (assignor to **The Dorr Co.,** of New York). 1,752,781. April 1st, 1930. In a process of manufacturing sugar in which the sugar-bearing juice is treated to precipitate impurities the step which comprises agitation of the treated juice for a period sufficient to obtain substantially complete flocculation and at a rate adequate to maintain a substantially uniform suspension of all flocs of substantially maximum size.—AGITATION AND SETTLING APPARATUS. **Frank A. Downes** (assignor to **The Dorr Co.,** of New York). 1,752,789. April 1st, 1930. Flocculation and sedimentation apparatus comprises a sedimentation compartment, rotary means therein for mechanically impelling settled solids to a point of discharge and a superposed agitation chamber discharging into said compartment.—CENTRIFUGAL BASKET. **Eugene Roberts** (assignor to **The Western States Machine Co.,** Salt Lake City, Utah). 1,753,023. April 1st, 1930. Claim is made for a centrifugal basket whose peripheral wall is provided with elongated openings extending in the circumferential direction of the basket, the rear walls of said slots having their inner edges forwardly offset in relation to the outer edges thereof whereby accumulation of the sticky content of the liquid against said wall is prevented.—SEPARATION OF FINELY-DIVIDED SOLIDS FROM LIQUIDS. **John W. Wickes,** of Tongaat, South Africa. 1,754,870. April 15th, 1930. Claim is made for the hereindescribed method of separating finely divided solids from liquids consisting in introducing liquid-carrying solids in suspension into the upper part of a chamber, constraining the said liquid to flow vertically downward through a plurality of chambers superimposed therein, withdrawing clear liquid from the highest zone of the superposed chambers, thereby causing a slow movement of the clear liquid towards the said highest zones and discharging a sediment which has settled on the tops of the superposed chambers in a direction to promote the said slow movement of the clear liquid drawn from the said highest zones.

UNITED KINGDOM.

ULTRAFINE, SOFT, GRANULATED SUGAR. **Bernard H. Varnau and Truman B. Wayne,** of Sugar Land, Texas, U.S.A. 1,751,298; serial 208,049. March 18th, 1930.

Objects of this invention are to provide substantially pure granulated sugar, the individual crystals of which are finer and softer than the finest high grade granulated hitherto produced; and to provide substantially pure granulated sugar which is free running and relatively non-hygroscopic, consisting of ultra-fine regular, soft crystals. There is an increasing demand in certain markets for such very fine "sucrose sugars." In endeavouring to supply the demand for an ultra fine granulated sugar, the inventors have discovered that instead of employing the relatively high densities and temperatures used in the usual crystallization process, by rapidly cooling a sucrose solution of a density and temperature corresponding to those at which syrup is discharged from the centrifugals in the usual crystallization processes, a substantially instantaneous complete, and regular grain setting is effected. Moreover, the concentration of the mother-liqour is so reduced that formation of subsequent crops of false grain is prevented. On crystallizing such a magma in a crystallizer, a massecuite is produced from which ultra fine, soft crystals may be readily and cleanly purged substantially free from any film of adhering syrup. These crystals need but little washing to remove the minor amounts of impurities present and are in condition for granulation by the usual methods. In the preferred practice of producing this ultra fine, soft sugar a sucrose solution either of cane or beet origin having a density of approximately from 75 to 85 per cent. solids by weight at 17·5°C., and preferably containing 80 to 82 per cent. solids, obtained by melting commercial sugars of sufficient purity, or by concentrating in vacuo high purity white liquors from refinery char-filters, or by diverting high purity granulated syrups from previous hard granulated strikes from the usual refining process, is passed through a heater and raised to a temperature between 140 and 212°F., and preferably to a temperature of 160°F., to melt false grain, or if substantially grain-free may be passed directly to a suitable cooling vessel. The solution is then rapidly cooled in any suitable apparatus and preferably by spraying the solution through an air chamber at atmospheric pressure against a cooling surface or jacket, to approximately from 95 to 130°F. and preferably from 110 to 120°F. The exact amount of cooling to obtain the best results is governed by the density, purity, and temperature of the liquor or syrup being treated and the size of the crystals desired. This rapid cooling causes a substantially instantaneous, complete, and regular grain setting. The solution is then discharged into any suitable crystallizing apparatus in which it is slowly agitated for a period of from one-half to 6 hours preferably for about 2 hours while the temperature of the mass is slowly reduced to approximately from 80 to 90°F. It is then spun in a centrifugal to free the crystals from the mother-liquor and carefully washed with a fine spray of water or low pressure steam to further purify the crystals after which the crystals are conveyed to horizontal dryers of conventional structure where they are dried substantially absolutely free from moisture. The mother-liquor thrown out of the centrifugal machine may be re-treated for the preparation of a second crop of crystals.

By starting with a hot super-saturated syrup of 75 to 85 per cent. solids, preferably 80 to 82 per cent. solids to facilitate spinning of the magma later, and crystallizing the sugar by cooling, an immediate grain setting may be obtained in sufficient number to prevent the formation of false grain later. Or, should some false grains form they will grow rapidly to a size which permits ready centrifuging. Since the magma is allowed to crystallize until the temperature is reduced to room temperature or below, the syrup around the grain has given up its sugar content to the extent that it will not crystallize further at the temperatures to which the finished massecuite is subjected in spinning. This eliminates the trouble mentioned above due to false grain formation in centrifuging the massecuite and the massecuite may be centrifuged at room temperature when convenient. The grain has been grown and nourished in a cool medium and the adhering syrup is no longer supersaturated; therefore, the objection to attempts to produce such sugar by other processes is eliminated. The

cool massecuite spins readily because of its even regular crystals, the absence of subsequently formed false grain, and the light mother-liquor on the crystals. In direct contradistinction to the difficultly purgeable soft sugar massecuites of lower purity, the massecuites made by this process spin with surprising rapidity and facility and very little wash water or low pressure steam is required to wash the sugar to nearly absolute purity. In fact, one has found that such sugars can be discharged from the centrifugals in a state permitting granulation even though no wash water is used on the sugar. While this is not the preferred practice, it illustrates the free purging qualities of this new type of sugar. The sugar produced by this process is of substantially absolute purity, containing approximately from 99·5 to 100 per cent. sucrose by weight. It is many times finer than the finest granulated sugar hitherto produced, the individual crystals being fine enough to pass for the major part through a 35 to 40-mesh screen. The crystals are relatively soft, and unlike commercial soft sugars are substantially free from any adhering film of syrup. The crystals themselves are substantially uniform and are of the monoclinic system. There is substantially no tendency of the sugar to form crystal aggregates and substantially no microscopic crystals adhere to the individual crystal as in the case of various other types of sugars. It is free running, substantially non-hygroscopic and has substantially no tendency to form lumps. It is very soft in texture, is clear white, and has a high brilliancy lustre. Moreover, because of its extreme fineness, purity, and freedom from adhering mother-liquor it is very readily soluble. Sugar of the character described herein can advantageously be prepared by the practice of the processes forming the subject matter of Patent No. 1,715,049 and co-pending application Serial Number 133,595, filed September 4th, 1926.

HANDLING DEHYDRATED BEET SLICES. **Arcos, Limited** (communicated by **Ivan Tischtschenko and Victor Tchefranoff,** both of Moscow). 326,058. April 11th, 1929. In conveying dehydrated beet slices from the store to the factory by means of conveyors, elevators, trucks, etc., a considerable amount of dust is formed, which is dangerous and detrimental. Therefore, the inventors propose that in the store where the dry slices are kept, or in close vicinity to it, be placed a cylinder with mixing and heating arrangements, the volume of the cylinder being equal to that of the complete diffusion battery. Juice from the diffusion battery, hot and cold water, can be brought to this cylinder by means of piping. The dry shavings are conveyed to the cylinder direct from the stores, as well as thin diffusion juice or water. The mixture of the dry shavings with the fluids is constantly agitated in the cylinder in order to maintain the mixture in such a condition that it can be pumped by means of centrifugal or piston pumps. This mixture is pumped along the pipes direct to the factory to the diffuser in commission.—FILTERING LIQUIDS. **J. A. Pickard,** of Acton, London. 324,924. August 1st, 1928. A filter comprises an assembly of sheets of wire gauze of such gauge and mesh and so disposed as to present transverse passages of tapering or stepped cross-sectional shape. Filter aid may be used, being supported in the transverse passages by keying or wedging action. In an illustration are shown three sheets of gauze of successively finer gauge and mesh, these being arranged to form tapering passages, in which the filter aid is retained. Sheets of cylindrical form may be used.—HARVESTING BEET. **E. A. R. Ericson,** of Olands Lindby, Sweden. 325,761. May 23rd, 1929. Beets and like crops are harvested by a hand operated fork, the shaft of which is pivoted to a support adapted to rest on the ground. A tread member projects from the side of the shaft. A curved knife for cutting off the beet tops is adjustably pivoted on the shaft and is actuated through a handle. A spring returns the knife to its original position.—FILTER. **E. W. W. Keane,** of Kingston-upon-Hull. 326,221. November 8th, 1928. Each of a number of shallow filtering compartments formed on the surface of a rotary drum is connected to suction or pressure means through channels formed in sealing strips at the sides or ends of the compartment so that the suction or pressure effect is uniformly distributed in the compartment.

United States.

(Willett & Gray.)

(Total of 2,240 lbs.)	1930. Tons.		1929. Tons.
Total Receipts, Jan. 1st to May 24th	1,105,256	..	1,774,985
Deliveries " "	1,306,736	..	1,497,982
Meltings by Refiners " "	1,183,470	..	1,250,709
Exports of Refined " "	16,700	..	40,000
Importers' Stocks, May 24th	235,791	..	375,234
Total Stocks, May 24th	518,651	..	687,231
	1929.		1928.
Total Consumption for twelve months	5,810,980	..	5,542,636

Cuba.

STATEMENT OF EXPORTS AND STOCKS OF SUGAR, AT APRIL 30TH.

(Tons of 2,240 lbs.)	1928. Tons.		1929. Tons.		1930. Tons.
Exports	1,324,049	..	1,872,581	..	460,505
Stocks	1,316,618	..	1,509,795	..	1,751,553
	2,640,667	..	3,382,376	..	2,212,058
Local Consumption..	35,970	..	28,377	..	18,566
Receipts at Ports to April 30th ..	2,676,637	..	3,410,753	..	2,230,624

Habana, April 30th, 1930. J. GUMA.—L. MEJER

Beet Crops of Europe.

F. O. Licht's Third Estimate at May 30th, 1930.

	1930-31. Hectares.		1929-30. Hectares.		1928-29. Hectares.
Germany	465,000	..	433,015	..	430,307
Czecho-Slovakia	237,000	..	227,258	..	250,475
Austria	33,000	..	29,687	..	27,695
Hungary	70,000	..	72,975	..	65,503
France	265,000	..	243,100	..	239,725
Belgium	58,000	..	53,550	..	58,291
Holland	60,000	..	55,002	..	65,255
Denmark	33,000	..	29,990	..	41,200
Sweden	35,000	..	27,467	..	42,621
Poland	210,000	..	242,014	..	230,385
Italy	110,000	..	116,111	..	112,120
Spain	85,000	..	80,000	..	84,000
Roumania	44,000	..	36,000	..	52,000
Bulgaria........................	22,000	..	20,600	..	17,000
Switzerland	2,000	..	1,160	..	1,600
Russia	800,000	..	784,000	..	769,000
Great Britain	127,000	..	92,800	..	71,220
Irish Free State	5,200	..	4,800	..	6,100
Other Countries	66,800	..	75,265	..	77,132
Total..............	2,728,000	..	2,624,794	..	2,641,629

United Kingdom Monthly Sugar Report.

Our last report was dated May 15th, 1930.

The dissolution of the single selling agency in Cuba did not have the effect of stimulating prices as was thought, but on the contrary prices generally have continued to fall. New record low levels have been established both in Europe and New York.

The price of Raws in New York fell to 1⅜ c.i.f. and the futures market for the current month touched, at one moment, 1.25. Cubans were heavy sellers on the New York exchange.

There have been many rumours concerning a Conference to be held between the European countries and Cuba and Java to try and limit the future crops in some way. So far, definite news of this Conference has not materialized.

Russia has been in the market as a buyer for 100,000 to 150,000 tons, but lack of finance has hampered this operation.

The Terminal Markets in London have been lower on the whole, although at one period there was a reaction of 4½d. per cwt. There were several thousand tons of Cane and Beet tendered on May, which month eventually finished up at 6s. 1½d. August moved from 6s. 5½d. to 6s. 3d. to 6s. 7½d. to 6s. 0¾d. to 6s. 3¾d., December moved from 6s. 7½d. to 7s. 0¾d. to 6s. 6d. to 6s. 8¼d., March sold from 7s. 9d. to 7s. 6¾d. to 7s. 9d. and May from 8s. to 7s. 9¾d. to 8s. The latest prices are :—

	AUGUST.	DECEMBER.	MARCH.	MAY.
Raw	6s. 3¾d. ..	6s. 8¼d. ..	7s. 9d. ..	8s. 0d.
White	8s. 5¼d. ..	8s. 11¼d. ..	— ..	—

At one period, the latter part of May, the trade bought heavily both from the British Refiners and the Home Grown factories. The Refiners reduced their prices by 3d. on May 13th, but they were advanced 3d. on May 16th. However, on May 29th they were reduced 3d. again. The latest prices are, London Granulated, 21s. 4½d., No. 1 Cubes 25s.

Business in Raw Sugar has been fairly active and the Refiners bought considerable quantities of beet and cane. July Cubans sold from 7s. 2½d. down to 6s. 9d. Afloat sugar also sold from 6s. 9d. to 6s. 8½d. A big quantity of Natals sold at 10s. 6d. for July/August shipment.

There is no fresh news from Europe except that F. O. Licht has slightly reduced his estimate of the beet sowings.

The Cuban crop is progressing satisfactorily and the stock in the island is estimated to-day at about 3,300,000 tons.

Arthur B. Hodge,
Sugar Merchants and Brokers.

21, Mincing Lane,
London, E.C.3.
10th June, 1930.

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Managing Editor - - - - NORMAN RODGER.

Technical Editor - - JAMES P. OGILVIE, F.I.C., F.C.S.

For **INDEX TO ADVERTISERS,** see pages xlvi.—xlix.

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No. 379. JULY, 1930. VOL. XXXII.

Notes and Comments.

The Outlook.

The situation in the sugar market remains lifeless, and there seems no early prospect of improvement. It is becoming more and more evident that the salvation of the sugar industry lies along the same lines as with other industries, like rubber, tin, oil, copper, etc.—an agreement amongst the big producers, if not amongst the whole body, to restrict or conserve supplies, so as to turn the market from a buyer's into a seller's benefit. LICHT claims that in the matter of any co-operation in the sugar industry Java must take the initiative, and in his issue of June 30th he quotes a number of press reports which suggest at the least that Java is considering the question seriously. One factor in the situation which may conceivably influence the Java sugar industry in deciding to enter on international negotiations lies in the degree to which existing shareholders of Java sugar concerns have acquired their interests at the top of the market in recent years; as Mr. GOLODETZ points out, if an appreciable section of these shareholders have paid for their shares a multiple of face value proportionate to the inflated rate of dividend paid in past years by the Java mills, then a 10 per cent. dividend nowadays implies a very small yield on the outlay, and such shareholders will feel the pinch almost as much as factory owners in other less favoured countries. But one can only conjecture whether that section is appreciable. Anyhow, at some of the annual meetings held in Holland, suggestions as to the necessity for some new sugar convention have not been wanting.

Consumption figures at the moment are not buoyant, a feature which has its effect in retarding the market recovery. The United States, for instance, is estimated by LAMBORN to have consumed 120,000 tons less during the first six months of this year, as compared with the quantity consumed during the same period of 1929, which latter on its part was an increase of 286,000 tons over the first half of 1928. The second half of 1929 produced a decrease of 145,000 tons as compared with the second half of 1928. LAMBORN calculates that for the second half of 1930 the U.S. consumption may regain 100,000 tons of the recent decrease. In the U.K. consumption so far has kept up with 1929, in spite of increased trade depression and increase in unemployment.

The European beet crop, without Russia, still points to a decrease as compared with 1929. Rain is wanted everywhere, and if the present spell of dry hot weather persists through the summer the deficit may prove greater

than at present anticipated. Russia reports an increase of 25 per cent. in its sowings, but it is impossible to say with any certainty whether the news is authentic. What we do know is that Russia has had to come into the market lately and buy Cubans to the extent of 185,000 tons, of which 135,000 has apparently been financed by means of a British Government guarantee, and in political circles has led to a minor hubbub, in spite of the fact that the sugar is being refined en route in British refineries. Whatever the political aspects of the case, the broad result is that an appreciable quantity of Cuban sugar is being taken off the overloaded market and this will be bound to add its quota to the influences which sooner or later will lead to a firmer tone.

The passing of the new American tariff (to which we refer below) has naturally resulted in the unloading of quantities of duty-paid sugars which have been indefinitely held for this purpose. But such is the depression in the market that these have after all been offered freely at a price based on the old duty, hence at the end of June prices had not been adjusted in the American market to conform with the new scale of duties. But the adjustment will not be long delayed.

The New American Tariff.

After some fifteen months of protracted wrangling, the American Houses of Congress have at length passed the new Hawley-Smoot Tariff Bill : and the President having signed it, it came into force on June 18th. Thereby an end is put to the interminable period of uncertainty in American trade, not the least in that of sugar, and though the sugar tariff is now raised further against the importers, to the figure of 2·50 for foreign and 2 cents for Cuban (as compared with the respective old rates of 2·20 and 1·76 cents per lb.), the trade at least knows where it is, and it may be presumed that a movement towards replenishing the diminished stocks of invisible supplies is in the ordinary course of things.

This Tariff Bill, as the *Times* summarizes it, has passed through many vicissitudes, and there have been times, especially after the severe mangling it received at the hands of the Senate, when there seemed very little chance of its ever reaching the Statute-book. It originated harmlessly enough in the desire of the President for a limited revenue to benefit the farmers and to redeem the promises he had made them during the Presidential campaign ; but the Ways and Means Committee of the House of Representatives and the Finance Committee of the Senate, egged on by the extensive lobbying of all the interests that hoped to profit from increased duties, have made of it "a monumental effort in the direction of high and comprehensive protection." It will be the highest in the history of the United States, and apparently American economists have all joined in condemning it ; but the influence of the trade interests has carried it forward on the crest of the wave, and there remains nothing but to test its effects, good or evil, on the economic fortunes of that country.

The Altered Trend of Visible and Invisible Stocks.

In an article which Dr. H. C. PRINSEN GEERLIGS contributed to the Amsterdam *Telegraaf* on May 22nd last, and which the Economic Committee of the League of Nations have seen fit to circulate for information, the present difficulties of the sugar market are largely ascribed to the fact that the distribution of stocks has changed during the last few years, and whereas in 1925 stocks were mainly invisible, they are now largely visible in the hands of the producers ; but Dr. GEERLIGS thinks it quite conceivable that the total

stocks to-day, both visible and invisible, are no greater than they were in 1925-26. The quantity has not altered, only the distribution.

Dr. GEERLIGS estimates the World consumption and production of sugar at the end of May last : Production he puts at 24,107,000 tons, consumption at 23,985,000 tons, there thus being indicated a balance of production of no more than 122,000 tons. (These figures do not include the native output of British India or China, nor the low grade sugars produced in certain countries). This surplus he deems is no more than can be regarded as lost through floods, fire, shipwreck, etc., or consumed on the high seas, stolen, or otherwise disposed of ; and he thinks there will be certainly no increase in the surplus during the current year.

However, the figures of the initial stocks of the last five statistical years show that whereas in 1925-26 these were on the small side amounting to 907,000 tons, by 1929-30 the total has increased to just over two million tons, that is in the space of four years, an increase that "need not be regarded as particularly disquieting " because it relates only to visible stocks. We have had a falling market for three successive years, and in such periods no one dreams of laying in invisible stocks, but reduces buying to a minimum. This, in Dr. GEERLIGS' view, is the decisive factor of the moment : buyers are keeping out of the market and leaving unsold stocks in the hands of the producers. The latter produce in three or four months as much as the consumers can use in twelve months. When buying was more evenly spread, the cost of storing the goods was divided between the producer and the purchaser; but nowadays the producer is left too long with unsold stocks and is obliged in the end to take a lower price than is warranted by the statistical position, while in view of the large number of consumers the advantage to the individual from this lower price is insignificant. Summing up, Dr. GEERLIGS considers that the statistical position with regard to sugar is sound, that stocks are not extraordinarily high, and that consumption is keeping pace with production. Once there is a certainty that prices will not fall further but may rise, buyers will start taking over a larger part of the sugar stocks, the surplus of which is now a drug on the market, and with stocks diminishing we shall see a healthier state of affairs.

Alternative Crops in Cuba.

Our Cuban correspondent remarked last month that about the only solution left to the Cuban Government in the present sugar crisis was to adopt discriminatory legislation and taxation and so encourage the native agriculturists to produce diversified crops. An American consular report on agricultural conditions in Cuba suggests that this need of crop diversification has already been brought home forcibly to the Cuban sugar planter and that with Government co-operation increased production of fruits and winter vegetables has ere now been started. Coffee production has increased, and tobacco farming is being carried on yet more extensively, while rice cultivation, inactive for many years, has been resumed at the instigation of the Government who are reported to have requested all sugar planters to plant a certain proportion of their land to rice. Dairy farming is being modernized and poultry farming is being conducted along scientific lines. Perhaps the most important recent development in Cuban agriculture has been the increase in irrigation. The system of de-foresting that has been carried out during the past decade has resulted in decreasing an unevenly divided precipitation, and has therefore made the problem of irrigation more urgent. In the case of sugar cane, contributory causes for irrigation have been the necessity of growing cane on

smaller areas in order to save long haulage and rents on cane lands, and the competition of mills for their supplies of cane.

There is much to be said for the view that Cuba would do better in future to diversify her crops rather than to stake her existence on building up one staple crop to such gigantic proportions that success depends on her finding an outside market to take nearly the whole of that crop, and market depression in that one commodity affects disproportionately the whole economic status of the island. It is becoming increasingly clear that the sugar interests of the world at large do not intend that Cuba (or for that matter Java either) shall have a disproportionate share in the production of sugar. Each country wants to produce as far as it can its own sugar supplies and only buy from the big exporters its excess requirements. If the movement for free trade, or at all events reciprocity, within the British Empire achieves practical success, as well it may in the not distant future, it is almost certain that the Empire consumer of sugar will be supplied primarily from Empire sources. The present output of beet sugar in the United Kingdom may yet be doubled, while our tropical dependencies may elect to send us the balance of our requirements. With this in prospect, it may well be argued that the day of a Cuba producing millions of tons of sugar for export to any chance market is threatened with extinction, unless indeed a one-day pacified China enters the world sugar market for greatly increased supplies. But it is fairly certain that even China will not indefinitely continue importing sugar, once she has the incentive to grow her own.

Work of the British Parasite Zoo.

We have referred on previous occasions to the work of the new Farnham House Laboratory founded by the Imperial Bureau of Entomology, in 1927, for the furtherance of the control of insect pests by what is known as the biological method, that is by means of beneficial parasites and predators. This laboratory which lies about 25 miles distant from London has become the Parasite Zoo of the Empire. In the three years of its existence appeals to investigate some seventy different kinds of insect and weed pests have been received ; and at least twenty different species of parasites have already been shipped to different parts of the world. The progress of the work and a detailed account of the problems to be faced will be found in a recent publication of the Empire Marketing Board, "The Biological Control of Insect and Plant Pests" (H.M. Stationery Office, 1s. net).

From this report we glean that in October, 1928, Dr. J. G. MYERS left for the West Indies, in order to investigate the possibilities of the method of biological control in the Islands, with special reference to the pests of sugar cane. As it was obviously undesirable to attempt the introduction of beneficial parasites from one West Indian island to another until precise information was available as to the actual position of each of the Colonies, Dr. MYERS' work during the past year has had to be almost entirely of an exploratory nature. He has visited Trinidad, British Guiana, Surinam, Barbados, Cuba, Jamaica, and Haiti, and many thousands of insect pests have been dissected or reared in captivity in order to ascertain what parasites were already present in each country, and the percentage of parasitism. A large body of useful preliminary information has thus been accumulated.

The position with regard to the Hymenopterous parasites of the small moth borers of sugar cane (*Diatraea*) in Trinidad and British Guiana was found to be so complex and puzzling, that it will be necessary to investigate the matter much more fully before the introduction of parasites is undertaken,

and it is probable that arrangements will be made locally for the appointment of a special entomologist to study the problem in each country. An apparently valuable parasite of these insects occurs in Cuba, a Tachinid fly (*Lixophaga*) and arrangements have been made with the Harvard Biological Laboratory in that island to collect a supply of this insect for introduction this spring into Barbados, in the first instance. Attempts to obtain parasites of the large cane borer (*Castnia*), the cacao beetle (*Stirastoma*), and the sweet potato weevil (*Euscepes*), on the mainland of South America unfortunately failed on account of the extreme rarity of these insects on their natural food-plants and time was not available for any extensive search. But this very rarity indicates that important controlling factors are in operation, and these should be worth examining when an opportunity is available.

The freedom of sugar cane from froghoppers in Cuba was found not to be due to any control by parasites. Possibly an important factor is the occurrence of lime in the soil in large quantities.

Mauritius and the West Indies.

From Barclay's Bank (D.C. & O.) Monthly Review we take the following information on current conditions in the British sugar colonies : *Mauritius.*—Trade conditions remain dull and no improvement is expected until the sugar season opens at the end of August. Rainfall up to the middle of May was below the average and the canes suffered in consequence, but thereafter it was more seasonable and an improvement in the cane crop resulted. The latter, it is estimated, will amount to 230,000 tons. Forward sales of sugar for shipment from September onwards total approximately 80,000 tons, consisting principally of raw sugars at low prices. In view of this, the Chamber of Agriculture, on behalf of the planters, is requesting the local Government to remit the export duty of 30 cents per 100 kilos and to postpone the annuity charge of about 36 cents per 100 kilos relative to the 1926-29 loans. *Barbados.*—Grinding of the 1929-30 sugar crop finished about the middle of May ; the return is reported to have been good, the tonnage of cane being quite up to, but the sucrose content slightly below, the level of the previous season. A committee has been appointed by the Governor of Barbados, with himself as chairman, to consider a scheme for stabilizing the price of sugar locally ; a request to the Imperial Government for a loan in this connexion has been declined. *Trinidad.*—The sugar crop now being reaped is estimated at about 76,000 tons, or approximately 15 per cent. less than last year's. The reduction is attributed to poor returns from last year's stand-over canes which had dried up considerably. It is announced that the Trinidad Government is proposing to afford relief to the local sugar producers by making advances under certain conditions out of the surplus funds of the Colony at the rate of £2 per ton of sugar exported during 1930. *British Guiana.*—The local sugar position is being discussed by the Legislative Council and hopes are expressed that measures may be introduced to provide some form of relief for the industry during the present crisis. Recent sales of rice to buyers in San Domingo indicate a possible new outlet for that commodity; if this market develops it should help to improve the position of the industry.

The "International Society of Sugar Cane Technologists."

The "International Society of Sugar Cane Technologists," an organization started a few years ago "to promote by means of triennial conventions the discussion of problems connected with sugar production in both field and factory," held its third congress at Soerabaia, in June, 1929. In the course

of the meeting the question of regularly collating and abstracting current technical literature on sugar was discussed, and it was resolved that an attempt be made to start a new periodical (or make use of the services of an existing periodical) to give "adequate abstracts in the English language, submitted by the authors themselves, of all technical papers of more general importance." A committee was there and then appointed to carry out the idea.

Failing the feasibility of starting a General Abstracts periodical of their own, one would have thought that in view of the international character of the Society its Publications Committee would see the wisdom of being strictly impartial in the matter of issuing abstracts to the existing press of the sugar world. It therefore comes as something of a surprise to learn that, for the start at any rate of the venture, they have elected to use as their medium of communication a particular sugar trade journal domiciled in New York, and not to offer simultaneous publication in any other sugar journal that may desire to put the Society's abstracts on record in its pages. An open letter has been sent out to the members of the Society giving the ostensible reasons for taking this step. It seems clear to us that the decision has been taken by the scattered members of the committee without their realizing the true inwardness of this exclusive policy, and that more careful ascertainment of the views of the members of the Society all over the world would have shown them the unwisdom of taking a step that will in many quarters be deemed a breach of the neutrality that is to be expected of an International society. We might well have expressed ourselves strongly in the matter, but we prefer at this stage to await developments, in the belief that when those who run the Society and their leading members have had more time to consider the full implications of the new proposals, they will be prepared to reconsider the matter. In the meantime, we publish on another page a letter of courteous protest from the pen of Mr. NOEL DEERR; and we have little doubt that there will be other British technologists who will deprecate the restriction of their communications exclusively to one trade journal.

The Dutch Sugar Beet Industry.

In 1929 the Dutch beet growers (according to a D.O.T. consular report), feeling apprehensive of the risks run at existing sugar prices reduced their acreage by 17 per cent. Fears were indeed entertained that the reduction would be much greater, and a Bill was introduced into the Legislature to grant a subsidy of Fl. 1·50 per 100 kgs. of sugar to the growers and so tide them over an uneconomic period. The First Chamber, however, in the end rejected the Bill, as in the course of the debate the conflicting interests of private sugar factories and those working on a co-operative basis became more and more apparent. The position of the private factories, which are owned by a trust, is such as to be able to draw on considerable reserves, hence the scheme to subsidize sugar was opposed, whereas only a few of the co-operative concerns are old enough to have formed sufficient reserves.

The total capacity of Dutch sugar works is sufficient to cope with a crop grown on 100,000 hectares, the maximum ever reached being somewhere round 75,000 hectares. The effect, therefore, of a reduction of the total area to 54,007 hectares only provided work for little more than 50 per cent. of the total capacity of the sugar factories. The result was that some of the co-operative works decided not to take part in the sugar campaign. These were the works built in the most expensive period and with the highest overhead expenses.

The methods of the co-operative works based on an annual fixed minimum contingent from the members of the co-operation have greatly affected the quantity available for these works, whereas the method of the trust which guarantees a fixed price before sowing naturally induces free farmers to deliver at a price leaving them a profit. In consequence of this policy the trust works have probably been able to produce at a much cheaper rate than the co-operative works, as the latter have, of course, not received anything like the quantity of raw material necessary for an economical working.

Since the rejection of the above Bill the Government has in some measure come to the assistance of the industry by reducing the excise on sugar and withdrawing the surcharge for the benefit of the sinking fund for war loans.

The Growth of Sugar Cane in Louisiana.

By ARTHUR H. ROSENFELD.

Consulting Technologist, American Sugar Cane League.

To the sugar man, accustomed only to the Tropics, who visits Louisiana in late spring or even early summer, it seems totally impossible that sugar cane, which is practically just starting to grow can produce excellent crops of fair sugar content only five or six months thence. He thinks of what seven or eight months' old cane in the tropics would be like, and, were it not for

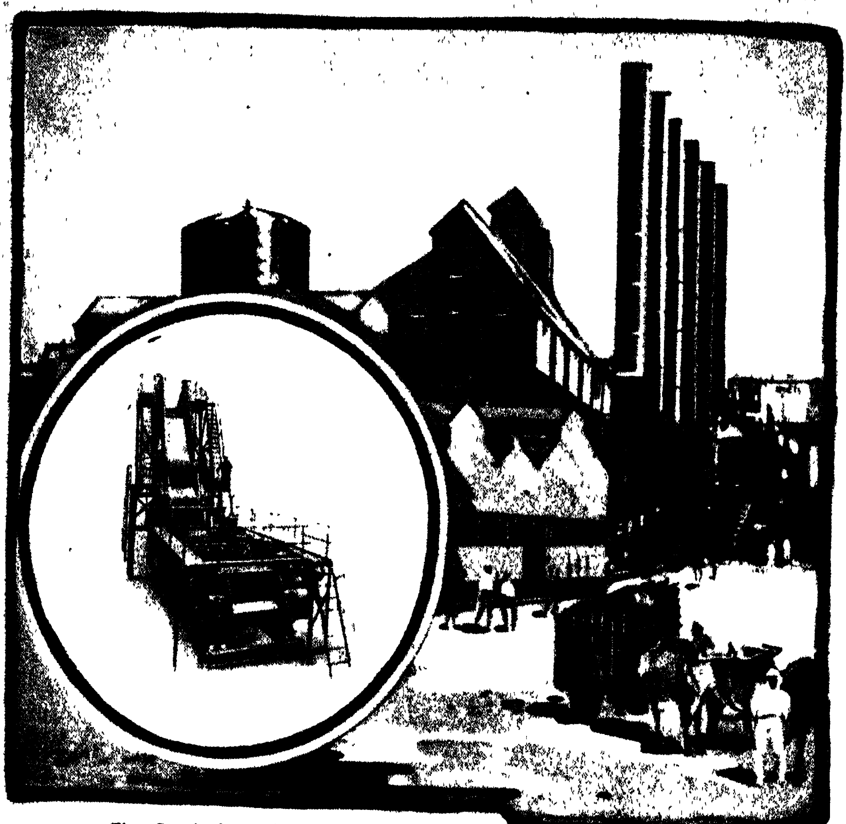
the fact that he knows that all cane is winter-killed each year in Louisiana, he would be inclined seriously to doubt the veracity of his Louisiana cicerone.

It is a fact, however, that in both Louisiana and Tucuman, the sister sub-tropical cane producing regions north and south of the Equator, growth is much more rapid and luxuriant during the maximum seven or eight months' growing season than in almost any part of the tropics, and, of course, the

incidence of cool weather causes the cane to start ripening at a much earlier age than is the case where such a climatic stimulus is lacking. The writer is inclined to believe that nowhere in the tropics does sugar cane grow so rapidly in a similar period as during the three or four months of high temperatures, humidity and rainfall characteristic of the summer and early fall of both Louisiana and Northern Argentina. Particularly favourable to rapid and continuous growth are the extensively hot and humid nights so typical of both sub-tropical countries, which the writer has never experienced over similar periods in the true tropics.

Even in these sub-tropical countries after a late spring, such as Louisiana experienced this year, the planters themselves are inclined to forget previous experience and wonder if there will be time to make a crop. For a number of years the writer has kept photographic records of the status of fields of different varieties in various sections of the State, and he has found of late

that the showing of some of these series, of what might be called visual records of growth in other years, to some of our alarmed planters has served, to a large extent, to dissipate their pessimism. The most recent comparison with the present late spring in Louisiana was the crop year 1928, when practically the entire development of that excellent cane crop occurred after the 1st of June. The three accompanying photographs, taken at two-monthly intervals with the camera the same distance from the varietal stake, will show graphically the truth of this assertion. They were made on Belle Terre Plantation, near Donaldsonville, Louisiana, and the writer wishes to acknowledge his appreciation to its owner, Mr. PERCY LEMANN. Without the backing of such a series of photographs, it would be difficult to credit such remarkable development to but four months of growth. This particular field of POJ 234 plant cane produced something over 25 tons of cane per acre at harvest time and showed excellent sugar content.



The Growth of Sugar Cane in Louisiana.

An idea of the rapidity of growth during a normal Louisiana summer may be obtained from the two tables following, the first being a series of measurements from the top of the cane ridge to the bud of the cane, made by Dr. M. V. MARMANDE on his plantation at Theriot in the Parish of Terrebonne with marked stools of the three commercially propagated POJ canes. As will be observed from this table, during a period of almost six weeks these varieties made an average growth of about $\frac{85}{100}$ of an inch per day.

The second table is a record of the growth of these POJ canes and the Louisiana Purple on the five test fields conducted by the American Sugar Cane League and the Louisiana Experiment Station under the supervision of Mr. CLAUDE B. GOUAUX. These figures show that, for the month of July, the growth of the POJ canes in the test fields averaged over an inch per day.

TABLE I.

GROWTH OF CANE IN TERREBONNE PARISH — 1928.

Variety.	Age.	Height July 23. Inches.	Height August 31. Inches.	Gain in 39 days. Inches.
POJ 36	Plant	54	89	35
POJ 36	Stubble	54	84	30
POJ 213	Plant	48	81	33
POJ 213	Stubble	49	81	32
POJ 234	Plant	55	85	30
POJ 234	Stubble	47	78	31

TABLE II.

AVERAGE DAILY GROWTH RATES OF TEST FIELD VARIETIES.

(Expressed in inches).

Variety.	CINCLARE. July 6th to August 2nd.	GLENWOOD. July 5th to July 31st.	RESERVE. July 6th to August 3rd.	STERLING. July 3rd to August 4th.	YOUNGSVILLE July 2nd to July 30th.
POJ 36	1·08	1·03	0·97	1·15	1·07
POJ 36M	1·04	1·15	1·14	0·97	1·00
POJ 213	1·11	1·23	0·78	0·97	1·11
POJ 234	1·00	1·23	1·04	0·97	1·11
Purple	0·92	0·80	0·89	0·97	1·21
FIRST YEAR STUBBLE.					
POJ 36	0·78	0·80	0·89	1·09	0·75
POJ 213	0·85	0·88	0·96	1·00	1·00
POJ 234	0·96	0·92	1·32	0·94	1·35
Purple	0·44	0·42	0·75	0·60	0·71

It may be of interest, also, in this connexion to mention that the writer, in measuring growth during three or four day periods of excessively warm rainy weather and oppressive nights in Louisiana and Tucuman, has found average daily growth to run from 2 to 2½ in.

In connexion with the above table showing the slower development of the Louisiana Purple cane as compared with that of the POJ's, some reference to the acre stalk population of the POJ canes as compared with the Purple (determinations of which were made in July, 1928), is illuminating, particularly as illustrating the difference in potential and realized yields of cane and sugar per acre. A large number of counts were made that month in various sections of the State of the average number of what were then considered probably millable stalks, per lineal foot, each count being made on several 100 ft. sections of rows. The number of stalks per 100 feet was then converted in terms of the 7200 lineal feet per acre existing where cane is planted in 6 foot rows. With the old Louisiana Purple and Striped canes,

only the best of these in the Western Section of the belt around Youngsville (where the virulence of mosaic disease had not at that time obtained its maximum) were counted, whereas the POJ canes of all conditions and of all varieties were included in the estimates.

The average for these counts—well over 100 of them were made—shows that there were at that time some 1200 stalks per acre in the case of the

Louisiana " Native " canes, as against an average of nearly 40,000 stalks for the three POJ varieties. The crop figures amply bore out the promise of these stalk counts, as the POJ canes on the fields under consideration produced an average of around 20 tons of cane per acre, against just under 7 tons for the Purple and Striped !

Celite Specialities.

A change of name has been made by Celite Products Corporation, of Windsor House, Victoria Street, Westminster, London, who have become Johns-Manville Company, Ltd. There will be no change in the directorate or personnel, and the business of the Celite Products Corporation in Silocel heat insulating products, and Celite Filter-Aids and Fillers will be carried on as formerly.

These products and the engineering service which accompanies them will, however, be greatly augmented by other insulating materials and by refractory cements, so as to cover all temperature requirements from the lowest sub-zero service to the highest industrial range. In addition, the Johns-Manville Company will offer technicians and industrialists an exceedingly wide range of asbestos products, including building and roofing materials, packings, brake and clutch linings, asbestos ebony (for electrical parts) and the materials and specialized service required for the acoustical treatment of buildings.

Ash Determinations by the Conductivity Method using the "Salometer."

By R. G. W. FARNELL, F.I.C., A.R.C.S.

Every year increased attention is being paid to the electrical conductivity or ash determination of cane and beet products. Interesting and useful results have recently been reported by different workers, such as : MAIN,[1] LANGE,[2] LUNDEN,[3] SANDERA,[4] SPENGLER and TÖDT,[5] ZERBAN and SATTLER,[6] HONIG,[7] RAULT,[8] MACDONALD,[9] FARNELL,[10] etc. There is now no question as to the great value of this determination in sugar-house control.

For the determination of the electrical conductivity, and the indication of the salts in solution, the author prefers the "Salometer" to other apparatus. It gives very accurate results, and is easy to manipulate. It is a definitely portable instrument, and can be set up for use anywhere, not being dependent on a lighting circuit.

VARIOUS APPLICATIONS IN SUGAR-HOUSE CONTROL.

Some of the more important occasions where conductivity measurements are of value are as follows :—

(1) *Ash in Raw and Clarified Juices.*—These figures not only indicate the quantity of final molasses to be expected (glucose in the case of cane factories being also required), but assist in a large extent in controlling the degree of liming, etc. A large increase in the ash ratio in the clarified juice, as compared to the raw juice, indicates a high proportion of organic acids and subsequent formation of lime salts. Generally speaking, the ash ratio in raw and clarified juice should not greatly differ, and the results of the Dutch beet factories are here of interest :—

	Raw Juice.			Clarified Juice.			Thick Juice.			Molasses.	
	1929.	1928.		1929.	1928.		1929.	1928.		1929.	1928.
Ash per 100 Brix	2·50	2·49	..	2·23	2·13	..	2·22	2·06	..	12·58	13·04

(2) *Control of Continuous Carbonatation.*—Conductivity methods are being successfully applied in the control of both first and second carbonatation in American and Continental beet factories.[11] The method is especially applicable to continuous carbonatation, the conductivity of the juice regulating the quantity of gas applied.

(3) *Control of Remelt Liquors.*—The Brix and polarization coefficients are necessary for determining the best mixture of run-off, remelt sugar, etc., for making up the *refonte* as is done in the Continental beet houses and refineries.

(4) *Control of Fresh Water for Diffusion and Boiler Feed.*—The conductivity measurements are of great assistance in controlling the diffusion and boiler feed-water, and also in assessing the refinery sweet-waters, where purity figures are of little use.

(5) *General Refinery Control.*—From the raw sugar throughout the refinery, the ash figures are probably of more importance than any other single determination. The works control of the largest refinery in England is made by extended use of conductivity and *pH* measurements.

(6) *Yield from Massecuites.*—Various formulæ have been proposed (ELLIOTT and CHAPMAN,[12] PITOT[13] and SANDERA),[14] for calculating the yield of sugar from

[1] *I.S.J.*, 1909, 334. [2] *I.S.J.*, 1910, 423. [3] *I.S.J.*, 1925, 671. [4] *I.S.J.*, 1927, 280 ; 671 ; 1929, 565. [5] *I.S.J.*, 1930, 159. [6] *I.S.J.*, 1928, 31 ; 1930, 155. [7] *I.S.J.*, 1927, 614. [8] Congress Proceedings, South African Sugar Technologists' Association, 1929, p. 46. [9] *I.S.J.*, 1930, 272. [10] *I.S.J.*, 1929, 86. [11] *I.S.J.*, 1927, 505. [12] *I.S.J.*, 1923, 607. [13] *I.S.J.*, 1916, 522. [14] *Zeitsch. Zuckerind Czech. Rep.*, 1929-30, 54, 361.

juices and from massecuites, based on the determination of the ash in the juices, syrup or massecuite, and in the resulting run-off.

ELLIOTT and CHAPMAN'S formula is similar to the *S.J.M.* formula, to which it was found to give more accurate results :—

$$\text{Recovery} = \frac{\text{A/S molasses} - \text{A/S juices}}{\text{A/S molasses} - \text{A/S sugar}} \quad \text{where A/S} = \text{Ash per unit of sucrose.}$$

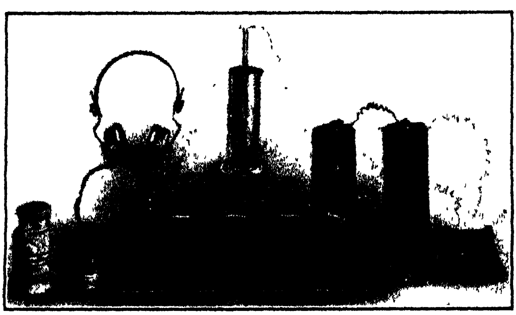
SANDERA has devised a method of conductimetric estimation of the crystal yield of a massecuite based on determining the conductivity of a massecuite and its run-off after separation in a laboratory centrifuge. Per cent.

$$\text{separated sugar} = \frac{100\ (\text{conductivity run-off} - \text{conductivity massecuite}).}{\text{Conductivity run-off.}}$$

The above formula refers to the separation of white sugar crystals ; if raw sugar is spun off, the percentage separated will be correspondingly higher.

(7) *Character of Juices and Sugars.*—HONIG[1] has pointed out that as organic non-sugars influence the electrical conductivity by impeding the passage of the ions, divergences between conductivity and gravimetric ash are due to the presence of the non-sugars. If two sugar solutions are similar in respect of Brix, ash content, yet one possesses a lower conductivity than the other, this would indicate less freedom of movement for the sugar molecules, and the solution would crystallize more slowly than the other.

This chemist examined the conductivity of samples of Javan cane molasses resulting from juices purified by carbonatation, sulphitation and defecation, and found that on a similar ash basis the carbonatation molasses



possessed the highest conductivity, while the sulphitation molasses had the lowest, defecation molasses occupying an intermediate position. This is in agreement with the quantity of non-sugars per 100 non-sugar precipitated by the three systems which have been found in Java to be approximately as follows :—

	Per Cent.
Carbonatation factories	17·7
Defecation factories	8·9
Sulphitation factories	5·8

(8) *Control of SO_2 in Raw Sugars.*—It is interesting to note in this connection that the recent committee set up by the Natal Sugar Technologists' Association to enquire into the presence and control of sulphur dioxide in Natal raw sugars, reported that in order to keep the SO_2 at a minimum, certain additional tests were to be added to the existing control. These tests included ash control using conductivity ash measurements.

[1] *I.S.J.*, 1927, 614.

Accuracy of the Conductivity Method.

Very recently Spengler and Tödt[1] have reported results on 108 different raw beet sugars whose ash content was determined both by the conductivity and incineration (sulphated ash) methods. They pointed out that the limit of error in the incineration method is about 0·02 per cent., while with the conductivity method (using 5 grms. of sugar in 100 c.c.) the error in 84 per cent. of the samples lay below 0·02 per cent., all the sugars being examined in duplicate. Generally, the incineration method gave slightly higher results than the conductivity method which is partly explained by the insoluble ash being recorded by the chemical method, but not affected by the electrical method.

Zerban and Sattler[2] have endeavoured to increase the accuracy of the conductivity method by determining the resistance of the sugar solution before and after the addition of hydrochloric acid, which is used in order to displace the weak acids. Their results have indicated that in the case of raw sugar products the accuracy is slightly increased, but the same does not apply to refinery products.

It would appear doubtful if this double conductivity method is worth while unless the greatest accuracy is needed, and certainly for control purposes one single determination is much more convenient. In any case, in refinery work with varying raw sugars, it is perhaps preferable for each refinery to determine appropriate factors for the various classes of products.

Another point in the conductivity method which has engaged the attention of many chemists is the Brix of the solution whose conductivity is required. Many have preferred to work at dilute concentrations at about 5° Brix or less, as at this dilution the depressing effect of the non-electrolytes present becomes small. By plotting the conductivity against the Brix for any sugar product, a curve is obtained which shows a maximum at about 28-30° Brix, after which the conductivity decreases, due to the viscosity. This effect has recently been clearly shown by MacDonald.[3] In spite of the advantage of determining conductivity at 28-30° Brix (since small changes of Brix have little effect on the conductivity) MacDonald's results with raw cane molasses conclusively showed that a better correlation was obtained when the conductivity measurement was carried out in dilute solution at about 4° Brix. The general practice now appears to favour working at low concentrations for all sugar products, Sandera recommending only 1·35 grm. of molasses in 100 c.c.

It is quite obvious that the conductivity method, while giving results at least as accurate as the gravimetric method, is far more convenient, since determinations can be made in a few minutes. The sugar chemist has now the advantage of a practical ash control throughout the factory or refinery, and in many cases the ash figure is quite as important as, if not more so than, the purity.

It will now have been seen that conductivity ash determinations have an important function in sugar house control. It is encouraging to notice that the conductivity method of ash determination is being brought up at the forthcoming conference of the International Commission for Uniform Methods of Sugar Analysis.

Death of H. W. Wiley.—Dr. Harvey Washington Wiley, the well known chemist who in his earlier days was associated with the sugar industry, has just died in Washington at the age of 85. He was the author of 225 scientific papers and 60 Government bulletins.

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[1] *I.S.J.*, 1930, 159. [2] *I.S.J.*, 1930, 155. [3] *I.S.J.*, 1930, 272.

Recent Work in Cane Agriculture.

REPORT OF THE DEPARTMENT OF SCIENCE AND AGRICULTURE, BARBADOS, 1928-1929. CHAPTER III. ECONOMIC BOTANY. REPORT OF THE GENETICIST, **A. E. S. McIntosh.**

In commenting on last year's Report on the Agricultural work in Barbados, attention was drawn to the great advance being made there in cane seedling work; and some idea of the thorough manner in which the subject was being tackled may be gathered from the facts presented in that article.[1] The present Report gives evidence of further progress. While the 1927-1928 Report was largely concerned with fundamental biological observations as to arrowing and the development of the flowers, in the present one these observations are in the background, and prominence is given to the use that may be made of the statistical methods of modern genetics in quickening up and stabilizing the work of selection. The Director of Agriculture has given his opinion that "since the arrival of the geneticist the technique of the cane seedling production work has been and is being so greatly improved, that one may regard it as the beginning of a new chapter." The following extracts will be sufficient to show the lines on which the geneticist is working. It must be allowed, however, that his duties appear to cover a much wider field than that of raising cane seedlings. He states with regard to his proposed work, that a two-fold policy is necessary: to aim at the reduction of the cost of sugar production and the control of pink boll weevil in cotton; and to introduce other crops in the case of the abandonment of either of these crops, such as tobacco, linseed and soy beans. The main headings under which the work on all the crops being investigated is to be considered are outlined as follows: the production of new varieties and their comparison with the standard ones, the study of the influence of environmental factors in the case of each, and correlation studies of the plants at different stages of growth, to enable early selection and elimination to be made. This comprehensive programme obviously needs a large staff, and we note that tobacco and cotton have provisionally been relegated to assistants. For the rest, this introduction of the statistical method in cane seedling work is impressive, and gives promise of attaining its object; but it will take some years before a reasoned judgment can be given of its ultimate advantages.

Sugar cane naturally receives most attention, and although severely compressed this part of the Report of the geneticist covers about a dozen pages, the headings being; introduction, breeding, selection in the young stages, selection at maturity, special experiments, and growth measurements. Comparatively few details are given, for it is proposed to work up these into a series of separate bulletins, as facts accumulate and aspects become important. In the introduction, the sugar area is divided into dry and wet, where the average annual rainfall is round about 45 and 60 inches respectively. It is obvious that different varieties of cane are best suited to such conditions; and BH 10 (12) is given as the standard cane of the wet region, while Ba 11569 is largely grown in the dry. But this seedling has the unfortunate habit of drying out rapidly during the cropping season, whereas B 606 and Ba 6032 remain unaltered, though having inferior juice. It is proposed accordingly to divide the cropping season into early, middle and late; and to select seedlings which are at their optimum in these three periods. If obtainable, they could be planted in the proportions desired and reaped in succession.

The parents used for *breeding* were the standard canes BH 10 (12) and Ba 11569, and recently imported Java seedlings. Unfortunately, little is at

[1] *I.S.J.*, 1929, 294.

present known as to the mode of inheritance of any particular character in the sugar cane, although from previous work a certain amount of information is available as to general tendencies. Thus it is known that Ba 11569 tends to produce seedlings significantly heavier than BH 10 (12); but it is necessary to study, not only the performance of the parent, but its ability to hand down certain of its characters. The economic characters are the most important and are largely quantitative; the qualitative characters, such as colour of leaf, may turn out to be of use as guides if correlations are established.

In framing the programme of breeding, the mode of pollination is separated into controlled, i.e., with the assistance of cages, and uncontrolled, or in the open. The former includes selfing and crossing of selected parents, the latter may include selfing, or crossing with any parent producing pollen in the neighbourhood. The first object aimed at was to be able to form an opinion as to the fertility of the sexual organs of the different varieties of promise, but not to obtain good seedlings; and this was done by counts of the actual seedlings produced, under the different methods of pollination, by the chosen parents. A Table gives the number of seedlings obtained per unit box, assuming that equal quantities of fluff are sown in each: the number of boxes in the cases referred to below varied from 6 to 35.

In the controlled pollination three varieties were selfed: Ba 11569 yielded 0·43 seedlings, B 381 0·05, and White Transparent 0·00 per box. In a dozen crossings only four produced more than eight seedlings per box: Ba 11569 × B 391 99·5, Ba 11569 × BH 10 (12) 92·3, POJ 2364 × B 391 31·6, and Ba 11569 × B 606 22·8. The uncontrolled pollinations give some idea of general female fertility: of seven varieties tested B 891 yielded 208·3 seedlings per box, and B 606 130; and the lowest were found in the boxes of BH 10 (12), 8·1, and B 381, 5·0. From these observations the value of Ba 11569 and POJ 2364 as female parents is established, while the use of B 381 and BH 10 (12) as female parents will be discontinued, the latter being only used as a male in crossing. The extraordinary fertility of B 381, 1250 seedlings in six boxes, arrests attention; and as "this year's studies show that it resembles Ba 11569 in the development of its sexual organs . . . . it is the intention to carry out controlled pollination with it during the approaching flowering season, to test its fitness as a female parent."

Seedling selection in the young stages.—The seedlings of 1928 were obtained from 8 parents in 12 combinations, by controlled or uncontrolled pollination. There were thus 12 different batches of seedlings (with the same parentage). About 300 of each batch were potted up and placed in cisterns for easy watering till they were 4½ months old, when they were planted out in the irrigated portion of the experiment station. The total number of seedlings grown in the cisterns and planted out was 3380, and to these were added 100 sets of each parent, making a total of 4180 plants, all of which were numbered, and then planted out at random, to rule out soil and other differences in the field. Before planting out, a selection was made of what appeared, in each batch, to be the "best" plants by simple observation (16 to 45 plants in each batch). This "observation" selection was designed to see if the plants, chosen for their apparent vigour in each batch, were of greater weight at crop time than the non-selected from the same batch. For this purpose, each selected seedling was weighed against the nearest unselected plant in the field belonging to the same batch. The average weights of the selected and unselected seedlings in 10 of the 12 batches are presented in a Table. In each case the selected seedlings were heavier, and in two of them were significant

in favour of the selected seedlings ; while, taking the means of all the batches, the difference in weight of the selected over the unselected averaged 5·09 lb. ± 0·97 "which is highly significant." There thus appears to be value in the observation method when applied to the plants at 4½ months.

Another method of selection among the young seedlings, termed "analytical," was also explored, namely by measuring various features for the same 300 seedlings of each batch while still in the cisterns. These features were : length of the longest leaf, width of the same leaf, length and thickness of the pseudo-stem, number of tillers, and angle of tillers from the vertical. These measurements were repeated at 8 months, and at 13 when vegetative development was at its highest. Correlations were then sought between these various measurements at the three periods, and correlation coefficients obtained between the seedlings at 4½ and 8 months, at 4½ and 13 months, and at 8 and 13 months. Each batch of seedlings was treated separately. "A high coefficient for any feature would indicate that that feature tended in any batch to develop proportionately in time in its 300 constituents; that the relative extent of development of that feature in each of the 300 plants of any one batch at 4½ months was similar at 8 and at 13 months. If this were so then selection could be made on that particular feature at the potted stage." The method does not profess to include the relationship between each feature and the weight of the plant or its sucrose content at crop time. This has still to be discovered. It is obviously of no value to find out that the broad leafed seedling at 4½ months is still broad leafed at maturity, unless the feature of broad leaves is linked up with some valuable economic characteristic. The results are given in a series of Tables. "The most striking fact in the summary of the correlation co-efficients over all features measured is that, while none, except those perhaps of the tiller number, are high, all, with few exceptions, give weak positive correlations. This indicates that for all there is a slight tendency for the relationships to remain similar at different stages. It has been proved from other experiments that tiller number is positively correlated with stool weight." This, it is pointed out, may partly account for the success choose plants with high tillering.

In another Table averages of the weights of the stools at harvest are given in nine batches—weights far below those usually obtained in variety trials presumably owing to the shorter growing period. Ba 11569 heads the list, followed by its crosses with BH 10 (12) and B 374 ; while BH 10 (12) has the lowest weight and B 465 is little better. "Since neither B 465 nor BH 10 (12) gives seedlings which show a consistently higher sucrose figure than seedlings from the other parentages shown, their use as female parents in breeding will be discontinued" (the second disqualification of BH 10 (12) in this respect).

Seed selection at maturity.—For comparing seedlings with the standard canes grown in the island the author presents the scheme on which he proposes to work. This scheme is a little difficult to follow without local knowledge, but the following appears to be the substance of it. It aims at obtaining varieties to suit the different districts, wet and dry, mentioned above ; and at the same time to provide early and late cropping varieties for each. Lemon Arbor and Dodds are mentioned as stations typical of the wet and dry districts. In Barbados the harvesting period lasts about five months, and this the author empirically sub-divides into early, middle and late : with the two districts, there will thus be six types to be desired. The seedlings are grown at Codrington under what appear to be unique conditions, namely under irrigation. At crop time the entire set of seedlings is separated into three lots, which are reaped in succession, at the end of January, in the middle of March, and at

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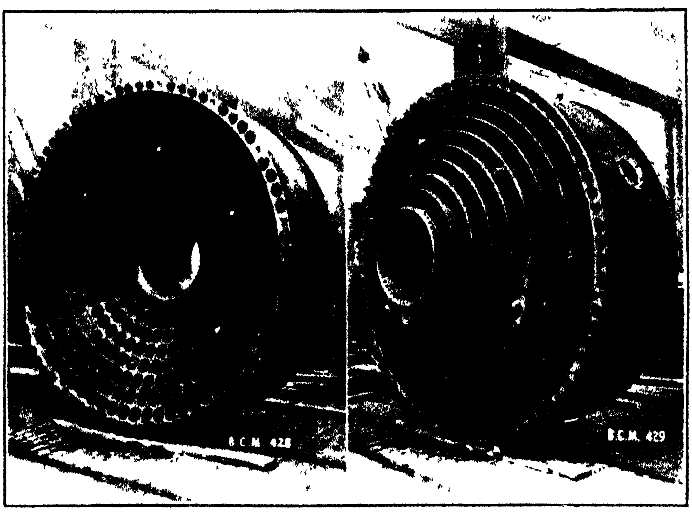

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the end of May, representing the early, middle and late periods of cropping respectively. Twenty seedlings are finally selected from each lot, and these are immediately planted at Codrington from sets, again under irrigation, so as to provide ample seed for further trial at the two stations in the wet and dry regions, at the proper planting season in November. "At each station each seedling will be retained in its original lot and compared with the local variety or varieties known to be best for that period for which its lot was selected, and each lot will be cut at the period for which it was chosen. A repetition of this lay out for three years at most should decide if any seedling is better than the standard check plants of its own lot at either station."

For the selection of the 20 seedlings for each lot from the seedlings of the year, about 2000 seedlings grown to maturity are cut, and approximately 100 are selected from these (1) in the field, for weight, habit, length and thickness and weight of cane, number of rotten canes, amount of trash, cleanliness of trashing, freedom from arrowing, and for the last lot freedom from drying out; (2) in the mill, for sucrose in the juice; and (3) in the laboratory, for the node and internode characters, buds, freedom from rooting, and nature of pith. The final selection of the 20 is then made, greatest importance attaching to the sucrose percentage of the juice, and the weight and habit of the stool. Various experiments were made to justify the use of the above mentioned features in the selection of seedlings grown to maturity: for it is obvious that such features must be permanent for them to be of value. Weight of stool and percentage of sucrose were thus tested during the years 1928 and 1929. For the former feature 19 were tested and 43 for the latter; and the correlation coefficients were 0·8371 and 0·6218 respectively (anything above 0·5 being considered satisfactory). These two characters therefore appear to be valuable selective features in first year plants.

Among *special experiments*, the most important appears to be one on the effect of variety and time of reaping on the percentage of sucrose. The results are shown in a Table, where the sucrose percentage in the juice is given for 20 varieties (Ba 11569 and 19 of its seedlings), cut at four periods of growth: in the middle of January, the first week in March, the second week in April, and the third week in May. The results are treated statistically—which alone makes it all the more desirable that this work should be treated in a series of separate bulletins as suggested by the author. In the analysis of the results the author remarks that "the importance to the plant breeder is that varieties differ in the times of optimum sucrose per cent. in their juice during the crop season." Such a result goes far to justify the new scheme of seedling selection.

ROTOTILLING CANE AT BLAIRMONT. **C. H. B. Williams.** *Agricultural Journal of British Guiana. Vol. II,* 3, *September,* 1929.

Reference was made in a previous article to the difficulties experienced in cultivating the cane fields of British Guiana;[1] and a couple of new implements were mentioned as having been introduced with the object of overcoming some of the handicaps and lowering the cost of production by largely replacing hand labour in the fields. In one of these machines, the rototiller, the action as the name implies appears to be on similar lines to that of FOWLER's patent gyrotiller,[2] although constructed on a much more modest scale. The actual performance of the rototiller is discussed by the Agronomist of the Sophia Sugar Station in the article under present reference.

In his introduction he remarks on the special desirability of intertillage being properly done before the closing in of the canes. The British Guiana

1 *I.S.J.*, 1926, 582. 2 *Ib.*, 1928, 36, and 1930, 192.

soils are chiefly very heavy clays, and, the rainfall being heavy, proper drainage is extremely difficult if not impossible. Where drains are very frequent and the canals are used as roadways any implement employed must be light for easy lifting, and yet strong enough to deal with the heavy soil. In practice, most planters are content to use the cutlass for weeding and the hand fork for cultivating ; but the cutlass does not destroy the weeds and the forking leaves large lumps of clay, slow to weather and having pockets between them holding water. The 8-10 h.p. Simar Rototiller. as worked by the manager at Blairmont estate, appears to have overcome these difficulties. A thorough inspection was made by the author, with free use of data on the estate books. At Blairmont the rototiller was used for intertillage between the ratoons, moulding the young cane plants, and preparation of the land for planting.

For working the machine the soil must be fairly dry. and it became necessary to calculate the number of days in the year on which it could be worked. At Georgetown the total of rainy days in the year is about 202, and of these he considers that those with over 0·1 in. rain are lost for work, that is, 140 days in the year during 1928. Actually, at Blairmont during the last rainy season the rototillers were able to work for 45 days out of 85, and the manager estimates that 138 days were lost out of 313 working days in the year.

In the cultivation of ratoons, using two machines following one another, it is possible if the soil is not too wet to cultivate 4 acres per day ; this cultivation being on alternate banks, the others being covered by trash. The soil is completely churned up, and finely divided to an average depth of 8 in. with a level surface ; the weeds are badly disturbed, mostly exposed and easily pulled out. For this work three drivers are needed (one for relief) and two boys to move the bridges ; whereas with hand forking the same work would require 30 men. Thus there is a considerable saving of labour units, releasing them for urgent work elsewhere.

Costs of treating 287 acres in this manner would be : wages $185.21, gasolene 257·56, lubrication 59·09, totalling $501·86, equivalent to $1·75 per acre. Allowing 50 per cent. for operating costs, repairs and depreciation, this would come to $2.62 per acre; and forking under similar conditions would be $4·50 per acre. It may be assumed that under local conditions a pair of machines can work for 175 days, and deal with 700 acres at a cost of $1850 : forking at $4.50 would cost $3150, a difference of $1300 or 70 per cent. of the cost of the machines. In lighter lands the forking would be cheaper, but the rototillers would work more quickly and the relative costs would be about the same.

The following summary of work on six fields of first ratoons under three different treatments is appended, each treatment being applied to two fields.

	Drilled.	Rototilled.	Forked.
Yield of sugar per acre, tons	3·59	3·71	3·64
Cost per ton of sugar, reaping to reaping, dollars	19·43	15·85	17·43
Labour units employed	758	194	616

Note.—Under rototilling the cost of working parts which could not be reached by the machines, and were hand-forked, is included. Drilling is described below.

The rows of cane are usually run across the narrow beds, which makes it necessary to provide small platforms to serve as bridges for crossing the open

drains. Experiments are in progress on working long rows running the length of the beds which would largely do away with the bridges; but further data must be obtained before this alteration can be recommended. Certain alterations are being tested with the wheels, by increasing the breadth of tread; this gives greater speed, reduces slipping and facilitates the "pick up" after the machine has crossed a bridge. By a local modification a very satisfactory moulding machine has been made to follow the rototiller in the mulch left by the latter. It throws the mulch on to the rows on either side, protecting the surface roots and encouraging tillering.

"It is customary in this Colony to make drills for planting with the hand fork. The bottoms of the furrows formed are then turned over with the same instrument, the operations consisting of pushing in the fork, taking out a lump of earth. and replacing it more or less upside down, on the spot whence it was taken. There the lumps are then chipped with the help of the shovel and the cutlass, and the cuttings stuck into the broken mass. In general, the seed bed thus prepared is not very satisfactory as the forking leaves numerous pockets in which water settles, and the chipping does not produce the even mass of fine texture which one would prefer. At Blairmont it has been found possible to bank the land with the fork and then pass the rototillers down the furrows. The result is the formation of an ideal seed bed. Where the land is light, it is possible to prepare a seed bed (every row) with one machine, at $1.46 per acre, depreciation excluded. In heavy lands two machines would be needed and the cost may rise to as much as $4 per acre."

The management at Blairmont is satisfied with the work of the rototiller, and claims that it reduces the cost of cultivating ratoons, enables work to be done at the right time, covers a greater area with the same labour force, is of great assistance in weed control, produces at least as good yields if not better, does moulding cheaply, efficiently and rapidly, and induces better germination. The cost of the machine is $900 landed, and the author suggests as the result of his investigation, that it might be tested elsewhere as to its suitability under the local conditions; but insists that such tests should be carefully planned and conscientiously carried out. The article is illustrated, and shows the working of the machines in the fields, and also with the tines exposed to show that it is not a plough (like the gyrotiller) but a cultivator.

C. A. B.

"SUCHAR" PROCESS.—In a recent advertisement for the "Suchar" process beneath a photograph of a bag-filling station is printed: "These bags are being filled with highest quality refined sugar in the Suchar process refinery attached to a tropical raw sugar mill. From cane to final product no raw sugar bags were needed or used. This means a saving for Someone, as compared with distant refining. If the raw sugar mill owner refines his product at the Central by the Suchar process, he is the Someone. There are other substantial savings too."

ANGLO-CEYLON & GENERAL ESTATES.—The annual report of the Anglo-Ceylon & General Estates Ltd., for the year ending 31st March, 1930, shows a net profit of £61,095 (against £82,586 for 1928-29) to which is added £38,032 brought forward. 10 per cent. is being paid in interest for the year (against 15 per cent.) absorbing £60,000, and £39,127 is carried forward. In Mauritius, including bought canes, 157,568 tons of cane were handled on the estates, producing a crop of 17,160 tons of sugar, as against 18,030 tons in the previous year from 162,826 tons of canes. Prices were again lower and fell below the cost of production, in spite of every economy which could be effected in the working.

South African Sugar Technologists' Association.

In Durban on April 15th to 17th the Annual Conference of the South African Sugar Technologists' Association was held under the Chairmanship of Mr. H. H. DODDS, Director of the Experiment Station, Mr. G. S. MOBERLY being Vice-Chairman. The meetings were well attended, and much interest was taken in the papers read, which are summarized as follows :—

MATHEMATICAL CONSIDERATION OF CANE SAMPLING.

G. S. MOBERLEY pointed out there are such great variations between individual sticks that each one selected affects the result. Likewise the selection of a complete stool, or a number of them from a field is valueless, as the same variations occur between adjacent stools. In a field containing stools of 11, 12, 13, 14, and 15 per cent. sucrose, if such were evenly distributed the average would of course be 13 per cent. ; but if only 1 stool were selected there would be two chances in five of a 2 per cent. variation ; two chances of a 1 per cent. variation, and only one in five of a fairly accurate result. If two sticks were taken, the chances in 25 tests would be six of a 1 per cent. variation. If three stools were taken, there are 125 different possible combinations ; of these 19 are accurate ; another 36 are 0·33 per cent. out ; 20 will be 1 per cent. out, and another 20 will be more than 1 per cent. out. Similar figures are calculated for larger numbers of stools, and a graph is plotted, it being shown that to get a reasonable sub-sample of any individual stool it would be necessary to take at least 8 or 10 sticks. This means from 64 to 100 sticks in the united sub-sample, much too large to manage. In view of these figures, and others which apply when sampling cut cane in the mill-yard or on the carrier, the author considers that the minimum requirements of cane sampling should be :—*Field Samples* : Take 10 stools at random from the field ; unite them, mix well and take out 40 sticks ; then sub-sample as described below. *Mill Samples* : Take 40 sticks at random from different parts of the consignment ; cut in half and take tops and bottoms of alternate sticks ; repeat the process until the final sample consists of forty quarter sticks. This is very cumbersome, but nothing less will give anything like reliable results. Cane sampling should only therefore be resorted to in exceptional cases and a greater accuracy than 0·5 per cent. in the sucrose reading should not be looked for.

TRUCKS FOR SUGAR CANE TRANSPORT.

The Committee on Railway Trucks reported on the standardization of the trucks of the South African Railways for sugar cane transport (South African gauge). They put forward three suggestions for the elimination of the wooden poles or props at present used almost universally to enable the full advantage to be taken of the carrying capacity of the truck ; (1) A telescopic steel tubular type of prop, which can be lowered out of the way when the truck is used for ordinary goods traffic during the inter-season. (2) A wooden framing on the inside of the waggon clipped to the top beading of the truck, and shored together at the bottom of the truck. And (3) a steel superstructure to raise the existing sides of the waggons. So far the Cuban system of tipping has not been adopted for the obvious reason that Natal mill yards and carriers would have to be re-constructed ; and also because the S.A. Railways would have to design a special truck which might be unsuitable for any other kind of traffic. The Convener (J. W. WICKES) recently toured the sugar growing belt of Queensland, Australia. There the main bulk of cane is transported on estate or mill 2 ft. gauge trucks. Where cane is handled by Government railways, no special type of waggon is used. Usually there were the low-sided ballast waggons with collapsible sides from which cane was

raked off by the Davies type of rake. The rate of transport is evidently fixed per ton and not at a minimum weight as in Natal, greatly to the benefit of the industry, though a doubtful advantage to the railway system. There the canes were loaded in various ways, sometimes crossways, others again longways and in some cases end on. Their trucks are not as large as ours are and probably 15 to 20 tons was as much as the average waggon would hold. In that country on account of the fact of cane being reaped at 12 months' growth, there is naturally less acreage under cultivation, consequently the cane is nearer the mill than it is in some instances in Natal.

Treatment of Mill Effluents.

Dr. Edgar P. Hedley read a paper on the waste-waters of a cane mill in Natal, at which a plant was built on the lines laid down by Dr. Park Ross and L. de Froberville,[1] but was continuous in operation. The waste-waters were made up of mill washings, floor washings, and wash-waters from the filter-press cloths. The plant used consisted of four tanks, *A*, *B*, *C*, and *D*, 3000 cub. ft. in capacity, pyramidal in shape, and closed at the bottom by a 3 in. cock; on entering tank *D* the water was treated with milk-of-lime and alumina ferric; and the precipitate was separated from the water during its overflow successively from tanks *D*, *C*, *B*, and *A*, there being a 3 in. fall between each. Whereas the water passed into the plant as a thick muddy effluent, it left as a clear yellow liquid without smell, with a strongly alkaline reaction, and containing 0·5 to 1·5 per cent. of sugar. If instead of keeping the clarified water alkaline as it comes from the settling plant, it had been made acid at once, as advised by Wallace Montgomery,[2] the water would have kept for weeks without undergoing any change. Beet factories in England are said to have overcome their effluent troubles by promoting lactic acid fermentation of the diffusion water in special ponds. They were able to do this because the effluent from the diffusers is hot, and when kept hot, 40-45 C., lactic acid fermentation sets in. Lactic acid fermentation is out of the question for Natal, because the waters are cold, and most factories have no surplus heat available to raise the temperature of these wastes. If the unsettled water ferments spontaneously there results an intolerable smell of sulphuretted hydrogen, which is a public nuisance; and if the clarified water spontaneously ferments, the smell of butyric acid, etc., resulting is almost equally objectionable. If the waters are not fermented, but merely settled, as is done by the plant described above, there is bound to be pollution in the river to some extent. Perhaps the solution will come from a different source, e.g., the winning of a different type of filter-cake such as the experiments with Oliver filters indicate might be obtained.

Standardization of Chemical Control.

This Report of the Committee on Standardization of Chemical Control (H. H. Dodds, Convener) is mainly concerned with the revision of the official methods of sampling and analysis which were adopted by the Association in 1927. These methods, introducing as they do a uniform system of definition of terms and procedure in sampling and analysis, and the interpretation of results, have proved of great value in making factory reports comparable. In general they are largely compilations of such existing specifications as appear to be most suitable for Natal conditions. Natal sucrose and the Natal ratio are defined, and also an ash ratio, viz., the reducing sugars per cent. divided by the ash per cent. In regard to the question of the single *vs.* the double

[1] *I.S.J.*, 1928, 376. [2] *I.S.J.*, 1929, 545, 602.

polarization, it was found at certain factories where both methods have been compared over a long period for the same samples that for normal juices the difference was less than the experimental error. In abnormal juice, however, the discrepancy may be appreciable. In the cases also of bagasse, filter-press cake, and raw sugars testing over 96° it is admitted that the pol. is equivalent to the sucrose. Sucrose is determined by a modification of the Herzfeld method of heating 50 c.c. of solution plus water plus acid to 69°C., removing the flask from the water-bath, and allowing it to stand for half-an-hour. Sugar is determined in bagasse by an apparatus which appears to be identical with that described by DEERR.[1] Reducing sugars are determined according to EYNON and LANE. SO_2 is determined by addition of an excess of N/32 iodine solution, and back-titration with thio. H.I.C. (*pH*) is found by the use of a comparator wherever possible, failing which the spot plate method is to be used. These methods in general are excellent, being well selected, and carefully described.

ANNUAL SYNOPSIS OF LABORATORY REPORTS.

H. H. DODDS and O. W. KARLSON mention in their report that 91 per cent. of the sugar produced in Natal comes from factories contributing to the mutual control system organized by the Experiment Station, that is 16 factories out of 25, the remaining 9, however, being small, only one having complete chemical control. During 1929 the total cane harvested was 2,818,000 tons, and the weight of sugar produced was 298,635 tons, making the tons of cane per ton of sugar, 9·44. During 1929 the sucrose content of the cane was 12·95 per cent., the lowest since 1925, viz., 12·55 per cent.; but the purity of the juice during 1929 was the highest yet recorded, and the fibre content the lowest. There was a fall in extraction, but the recovery on the juice was 84·39, due to reduced losses, including those in the molasses. An overall recovery of 75·13 is the nett result, an improvement on any previous year. No. 1 factory in the list producing 32,753 tons (a S.A. record) had the highest extraction and highest recovery in the juice, attaining an overall recovery of over 80 for the first time in any factory in S.A. Other data included in the 1929 returns are:—Fibre, per cent. cane, 15·52; sucrose per cent. bagasse, 4·07; water per cent. bagasse, 50·69; maceration per cent. cane, 25·54; extraction, 89·02; b.h. recovery, 84·39; overall recovery, 75·13; Java ratio, 76·79; Natal ratio, 76·83; purity of first crusher juice, 88·81; purity mixed juice, 86·04; purity last mill juice, 80·72; purity of syrup, 87·44; reducing sugars ratio, 3·35; sucrose in press-cake, 6·15; final molasses purity, 45·11; polarization of sugars, 97·87. Losses were: sucrose in bagasse, per cent. sucrose in cane, 10·99; in press-cake, 2·06; in molasses, 9·82; undetermined sucrose per cent. sucrose in cane, 3·02; sucrose lost in b.h. per cent. sucrose in cane, 13·56; and sucrose in total losses per cent. sucrose in cane, 24·39.

REPORT ON FIBRE TESTING.

The Sub-Committee on Fibre Testing (G. S. MOBERLY, Convener) report that experiments were carried out to determine the relationship between juice expressed and fibre, as well as to investigate the possibility of establishing a satisfactory lixiviation method. Samples of cane were shredded in a high-speed machine, and weighed portions expressed under 1 ton per sq. in., the juice obtained being measured. The result obtained showed very wide individual variations, but when grouped and averaged it was apparent

[1] *I.S.J.*, 1915, 218.

that a relationship exists between the juice expressed and the approximate fibre range and Java ratio. More information, however, is necessary before this fact can be properly applied to fibre determination. A method was evolved for the determination of the fibre in cane by the lixiviation method, viz.; 100 grms. of finely shredded cane are placed in a cylindrical container made of Peck strainer gauze, fitting closely into a tin billy-can. A tube connected with the condensed water line is inserted directly into the sample in such a way that the issuing stream of hot water imparts a circular motion to the contents of the can, the water overflowing through a hole 2 in. below the top of the can. After extraction for two hours the sample is dried and weighed. In this way a "moderately reliable" result was obtained, a longer time giving lower figures. This appears to be a useful and reasonably accurate method if all its conditions are standardized. However, when an attempt was made to apply it to all consignments of cane crushed, the results were again entirely nullified by the sampling error. The present impossibility of taking accurate representative samples of cane in fact renders impossible the immediate application of the fibre clauses of the Fahey agreement.

SO_2 Content of Natal Sugar.

D. J. Coghill reports on the results of the examination of over 100 samples of sugars, obtained from 15 factories during 1929 in Natal. Regarding the sulphide stain method,[1] he says that for refined sugars and for cargo sugars containing small amounts of SO_2 it is suitable and accurate. However, in the case of samples containing considerable amounts of sulphur dioxide the quantity to be taken would necessarily be small, and the error due to non-uniformity of sample large. Various chemists have recommended the iodine titration method[2] as sufficiently accurate for works' purposes, and the author uses it in his laboratory as a routine method. It was found in the case of a Natal cargo sugar made by the carbonatation process that considerable differences were obtained by iodine titration as compared with the distillation method, the former giving 13·3 and the latter 5·5 p.p.m. That some iodine-reducing agent was present that was not SO_2 was demonstrated by absorbing the products of distillation by the Monier-Williams method.[3] From the tabulated results of 104 samples of sugars examined for SO_2, it appears that the figures for iodine titration range from 14 to 288, and for the distillation method from 4 to 370 p.p.m. Of 60 samples examined by the distillation method, 15 per cent. of them contain over 70 p.p.m. of SO_2. The average results in p.p.m. calculated for the different samples received from various Natal factories submitting two or more samples appear in the table below :—

Sugar.	Number of Samples examined.	SO_2 by Distillation	Number of Samples.	SO_2 by Iodine Titration.
Cargo	2	31·5	6	63·0
Raw	3	36·6	3	42·4
Cargo	9	37·6	25	60·2
Cargo	3	30·2	3	60·4
Raw	4	202·7	2	231·7
Raw	2	67·7	—	—
Refinery	6	42·2	7	51·2
Export	—	—	3	51·8
All Sugars	25	42·8	21	51·9
Cargo	—	—	2	37·1
Raw	—	—	7	57·0

[1] *I.S.J.*, 1926, 644. [2] *I.S.J.*, 1911, 276; 1927, 331, 538. [3] *I.S.J.*, 1927, 371.

ENQUIRY INTO THE PRESENCE OF SO_2 IN RAW SUGARS.

This is a summary of a paper prepared by a sub-committee, urged by the seriousness of exporting raws to England containing more than the permitted limit, viz. 70 p.p.m. of SO_2. Sulphur dioxide is used in raw sugar factories in S.A., and in some cases obviously in excess, sugars received from CHAKA'S Kraal, for example, containing 336 p.p.m., present mainly as sulphite. Poor clarification is at fault, and the following tests should be incorporated in the control :—

(1) Sulphur dioxide determinations in the sulphited raw juice, clarified juice, syrup and sugar. (2) Ash control, using conductivity ash measurements (3) Lime determinations by soap test. (4) Turbidity of clarified juice and syrup using Kopke "Turbidimeter." Drought stricken canes from the milling plant should be excluded and canes properly topped ; efficient screening of cush-cush from the mixed juice is important ; the milling plant must be kept clean and free from fermentation, the use of steam jets and antiseptic sprays for cleaning down being strongly advocated. In clarification the mixed juice should be heated to 140-160°F. and treated with lime so that after sulphiting to 2500 to 3500 parts per million, the resultant juice is not acid (about 90 per cent. of the total lime used for clarification should be used at this point) corrected to slight phenolphthalein alkalinity (*pH* 8·3), and the final adjustment made with phosphoric acid to *pH* 7·4 to 7·8 ; heated up to 208°F. and subsided for 1¼ to 1½ hours. Clarified juice should be clear and bright and have a *pH* of 7·2 ; and only clear juice from the subsiders should ever be allowed to enter the evaporating system. The syrup should be kept over 55° Brix ; it should be subsided at 80°C., but must be 7·2-7·3 *pH*. If the lower grades of sugar are still high in SO_2 the following procedure is prescribed : All molasses for re-boiling are diluted to 50-55°Brix, limed if considered necessary, boiled in blow-ups, skimmed and subsided for 12 to 18 hours for first and second molasses. Molasses bottoms should be retreated, settled and the final bottoms discarded.

HAWAIIAN CONTROL METHODS.—Revision of the well-known "Methods of Chemical Control" of the Association of Hawaiian Sugar Technologists, last issued in 1924, is now under way. Each chapter is being dealt with separately by different members. Several new methods of analysis will be included, and some of the old methods revised. Tables 6, 7, 10, 14 and 17 will be omitted, and 1 and 3 combined ; while 4, 5, and 12 will be extended. Additional tables will cover cane ratio, sugar ratio, e.m.f. and *pH* values. The binding will be improved.

"SUPER-CEL" FILTER-AID.—In a recent advertisement for this product, the filter-station is likened to the neck of a bottle. "Super-Cel widens the neck of the sugar production bottle. This high speed filter-aid increases the length of the cycles. It speeds up filtration by removing the operation of filtering from the actual filter-cloth to the surface of a porous filter-cake. It protects the filter-cloth from becoming clogged by slimes and gums. Super-Cel can double or treble the capacity of your filter-presses. It will cut your filter-cloth expense in half."

KAY GROOVES.—A new form of groove has been adopted in Porto Rico as a result of feeding difficulties. It is known after Mr. Norman Kay, chief engineer at Aguirre, where first put to use. It is a channel groove cut diagonally across the roll from side to side through and below the annular V-groove. This channel groove tends to pack with fine bagasse and furnishes a roll surface that will practically eliminate slipping—settings and feed roll conditions being favourable. Some use Kay grooves on flat surfaced top rolls in combination with Messchaert grooves on flat surfaced back rolls, and with success. In these cases the mill efficiency has remained unaltered; but the life of such rolls, as they would require no regrooving, would be greatly extended.

Some Cost Figures of Sugar Production.

In the lately issued Report of the West Indian Sugar Commission the following table, adapted from one recently published by Lt.-Col. Ivan Davson, shows as nearly as can be estimated from data available the costs of production of sugar in various producing countries at the present day.

Countries in order according to production costs.	Cost of Production.* Per Cwt. s. d.	Per Ton. Dollars.	Per Pound. Pence.	Per Pound. Cents.
Cuba (*a*)	8 4½	40·60	0·90	1·80
Java (*b*) Mainly White Sugar	9 3	44·40	0·99	1·98
Fiji (*c*)	12 3	58·80	1·31	2·63
British West Indies (*d*)	12 4½	59·40	1·32	2·65
Hawaii (*e*)	13 6½	65·06	1·45	2·90
South Africa (*f*)	15 8½	75·42	1·68	3·37
Germany (*g*)	15 11½	76·56	1·70	3·40
Formosa (*h*) High Grade	17 7	84·40	1·88	3·76
U.S. Beet (*j*)	18 8	89·60	2·00	4·00
Australia (*k*)	23 0	110·40	2·46	4·93
Argentine (*l*)	24 3	116·50	2·60	5·20

*F.o.b. including repairs, renewals, taxes, interest; excluding depreciation and interest on capital.

(*a*) Based on $5·25 per bag at factory with 55 cents per bag charges to port, as given for a large group of factories in 1929, rigid economies being practised at the expense of proper maintenance.

(*b*) The Annual Report for two estates gives costs in 1927 as equivalent to 2·00 cents per lb. The *I.S.J.* of November, 1928, quotes equivalent to 9s. to 9s. 2d. per cwt. and "somewhat lower for 1929." 4½d. average charge from ex store to f.o.b. is added.

(*c*) Average for years 1923-28 as given by Mr. F. C. T. Lord of the Colonial Sugar Refining Company and can be considered normal cost.

(*d*) Average cost of production at factory of all returns to Commission for British West Indian sugar for year 1928 with 10s. per ton added for charges of placing sugar f.o.b. This is an average year and includes all normal maintenance charges.

(*e*) Actual cost of an average size Hawaiian factory in 1928 (producing over 20,000 tons of sugar).

(*f*) Figures as submitted in the report on the sugar industry by the Board of Trade and Industries, 1926.

(*g*) Published estimate for a medium factory dealing with from 25,000 to 50,000 tons of beet in 1924-25. Bridges and Dixey (Beet Sugar in France, etc., 1928) quote figures for growing and manufacture which support it. League of Nations (C.303 M. 104.1929) records an estimate equivalent to 17s.

(*h*) Costs of production from the *Japan Sugar Trade Review*, 3rd November, 1928. Rosenfeld (*I.S.J.*, September, 1929) quotes higher figures, dependent on cost of canes.

(*j*) Evidence before the Committee on Ways and Means of the House of Representatives in Washington, 1929, varied from $3·80 to $6·07 per 100 lb., the latter figure including "interest on indebtedness and a modest return on capital."

(*k*) Maxwell gives £25 per ton for 1928. The Brisbane correspondent to *Facts about Sugar* (issue of 9th September, 1928) gives "at least" £23. Victorian Minister of Agriculture is reported as quoting £23.

(*l*) According to findings in Arbitrator's report on conflict in Argentine sugar industry, 1927 (excluding amortization and interest on capital).

South African 1930-31 Crop.—While an accurate estimate of the 1930-31 cane sugar crop in South Africa is not yet possible, it is considered (says the Standard Bank of South Africa Monthly Review) that 325,000 tons of sugar will be manufactured. The unsold carry-over stock of 1929-30 manufactured sugar is stated to be approximately 20,000 tons, as compared with 34,000 tons last year.

British Beet Factory Annual Reports.

THE ANGLO-DUTCH GROUP OF FACTORIES.

The following in tabular form gives the results of the five factories of the Anglo-Dutch group, for the year ended March 31st, 1930, compared with the results in the previous season.

—	Ely	Cantley	Kelham	Ipswich	King's Lynn
Net profit—					
1929-1930	£126,490	£150,318	£11,363	£61,396	£51,787
1928-1929	£115,233	£103,807	£14,402†	£50,640	£36,836
Div. tax free—					
1929-1930—	12½%	20%	5%*	12½%	10%
1928-1929	12½%	20%	5%*	12½%	8%
To reserve—					
1929-1930	£70,240	£50,318	£8,238	£11,396	£6,787
1928-1929	£58,983	£3,807	£17,527‡	£640	£836
Sugar Content—					
1930	16·83%	18·18%	18·42%	17·90%	17·20%
1929	16·50%	18·40%	17·36%	18·14%	17·24%
No. of Growers—					
1930	2,932	2,937	1,222	1,332	1,416
1929	2,567	2,478	1,111	1,066	1,004
Price paid to growers per ton—					
1930	50s. 1d.	54s. 7d.	55s. 5d.	53s. 8d.	51s. 4d.
1929	49s. 1d.	55s. 4d.	52s. 0d.	54s. 6d.	51s. 6d.
Acres Grown —					
1930	24,392	26,206	6,215	14,146	16,004
1929	21,338	22,128	5,185	11,577	11,587

The smaller dividend shown for Kelham is due to the Government holding in the shares. During the establishment period which has now expired the Government have guaranteed under certain conditions a dividend of 5 per cent. per annum on the shares other than those held by the Ministry of Agriculture. The 250,000 latter shares have not ranked for dividend, but they rank in future, pari passu, with the remaining 250,000 shares. So long as the Ministry holds shares in the company no dividend in excess of 5 per cent. can be paid, but the company can purchase the Ministry's shares at par.

The Times Financial Editor remarks, apropos of these results, that they are certainly encouraging, having regard to the fact that the subsidy is gradually declining. But it would be more satisfactory if the companies showed more clearly how the results are arrived at and to what extent higher efficiency may have contributed to the profits. If the tonnages were given and the amounts of the subsidy, the accounts would be much more informative than at present.

CENTRAL SUGAR COMPANY.

The report of this Peterborough factory for the year ended last March shows that the net profit, after placing £65,000 to depreciation, was £56,075. Adding the balance brought forward, there is a total Credit of Profit and Loss of £125,662. After putting £28,125 to investment depreciation, and £40,000 to general reserve, the directors are paying, out of the balance, 15 per cent. tax free (as against 10 per cent. tax free) and carrying forward £6287 (as against £69,587).

* Less Tax. † Loss. ‡ From reserve.

WEST MIDLAND SUGAR COMPANY LTD.

The report of the Kidderminster sugar factory for the year ended March 31st last shows the following results : Profit for the year, after providing for interest, trading charges, and income tax, £53,909. 17s. 7d. ; transferred to Depreciation Account, £25,000, leaving £28,909. 17s. 7d. Balance carried forward from last year, £51,565, 1s. 0d., making at the credit of Profit and Loss Account, £80,474. 18s. 7d. The directors recommend a dividend of 10 per cent. per annum (free of tax), amounting to £18,000, and carry forward £62,474. 18s. 7d.

SHROPSHIRE BEET SUGAR COMPANY LIMITED.

The profit and loss account of the Allscott factory (near Wellington) showed that the net profit carried to the balance sheet was £91,492. 15s. 4d. The sum of £65,000 had been written off the cost of the factory. Dividends of 10 per cent., less tax to all preferred ordinary shareholders, and 20 per cent., tax free, to all deferred ordinary shareholders were declared. The acreage cultivated was 10,743 and the factory received 114,000 tons of roots. In 1930 the factory has contracted for 16,730 acres.

The British Beet Sugar Industry.

Official Report and Statistics for the 1929 Season.

The Ministry of Agriculture in their "Agricultural Statistics for 1929, Part I"[1] give the following particulars dealing with the 1929-30 sugar beet season in the United Kingdom.

A notable feature of the year 1929 was the complete recovery of the sugar beet area from its setback in 1928, when the acreage was reduced 21 per cent. as compared with 1927. The acreage of 1929, 229,918 acres, constitutes a record for this country, being 7352 acres or 3 per cent. more than the previous greatest area returned in 1927, and 54,184 acres or 31 per cent. over the 1928 area. The recovery was fairly general throughout the country ; it was very noticeable in Norfolk, where the acreage increased by 12,375 to 53,438, easily the highest in any county.

The improved position in 1929 is chiefly attributable to the good results achieved in 1928. These undoubtedly restored confidence and proved that, even with the reduced price which came into force upon the reduction of the subsidy in 1928, good cash returns could still be obtained. No doubt, also, the poor prices realized for the potato crop induced growers in many localities to increase their beet acreage, whilst the decision of the factories to bear all costs of transport above 8s. per ton increased the acreage in the districts more remote from the factories. The number of growers increased from 25,860 in 1928 to 32,000, and of these 5,000 grew over 10 acres of beet.

No new factories were erected in 1929, although a few slightly extended their beet-slicing capacity. A scheme to erect a beet drying station near Taunton in Somerset, in connexion with the Desiccation Process factory at Eynsham, was abandoned.

The following table shows the total quantity of sugar beets received at the eighteen factories working, as compared with those for 1928-29. Based on these figures of factory beet receipts, which are subject to slight revision, the average yield was about 8·7 tons per acre, compared with

[1] Vol. LXIV, Part I. H.M. Stationery Office. 1s. net.

7·7 in 1928 and 6·5 in 1927. The increased yield of 1 ton per acre over 1928 is a considerable improvement, and is actually the highest return so far recorded in this country, being about 2 cwt. over the previous highest in 1926. It must be admitted, however, that this is still well below the normal yields obtained in most Continental countries.

	Factory.	Washed and topped beet delivered to factory.* 1928-29. Tons.	1929-30. Tons.	Rated beet slicing capacity per campaign of 100 days. Tons.
1.	Cantley	166,697	225,004	240,000
2.	Kelham	32,609	60,130	75,000
3.	Ely	198,125	251,405	240,000
4.	Ipswich	79,397	126,260	125,000
5.	King's Lynn	89,508	137,747	120,000
6.	Colwick	55,352	92,741	100,000
7.	Spalding	58,286	90,275	100,000
8.	Kidderminster	75,718	94,561	100,000
9.	Poppleton	35,522	54,053	100,000
10.	Felstead	38,204	75,872	100,000
11.	Bury St. Edmunds	157,998	208,810	200,000
12.	Wissington	64,570	84,412	90,000
13.	Peterborough	79,743	114,024	80,000
14.	Selby	50,516	87,620	80,000
15.	Allscott	70,746	114,104	80,000
16.	Bardney	52,358	99,493	100,000
17.	Brigg	38,338	64,122	70,000
18.	Eynsham	14,949	18,800	22,000
	Total	1,358,636	1,999,433	2,022,000

The weather in 1929, taken as a whole, was favourable to the crop. The very severe frosts in late winter and early spring broke down the soil and greatly facilitated the preparation of seed beds. The seed germinated well, and, although late sown crops were slightly affected by drought, a much better stand of seedling plants than in former years was as a rule obtained. The very hot and dry summer months retarded growth considerably, but no serious damage was done except on very light soils. In some localities the crop suffered owing to attacks of Black Aphis and Mangold Fly. Drought continued through August and September, keeping the average weight of the roots low, but at the same time increasing the sugar content. There is little doubt that had these conditions continued, the crop would have ripened off early, with a light yield and high sugar content. The weather broke up, however, in the middle of October, and throughout November and December rain fell copiously, conditions at the same time being mild and free from frost. In these circumstances the beets started growing rapidly, and so exceptional was the weather, that the roots continued to increase in weight right up to the first week of January, when the last were being lifted.

The final average yields were accordingly increased, although, as was to be expected, the sugar content fell as the weight rose. Nevertheless, the final average for the sugar content is still high for the country as a whole, averaging, so far as can be ascertained, 17·7 per cent. as against 17·4 per cent. in 1928 and 16·1 in 1927. The purity of beets was about 88 per cent., the same as in the previous year, but slightly higher than in 1927. Harvesting in the early part of the lifting season was carried out under ideal conditions and dirt tares were at first exceptionally light. Later the wet weather made

* These figures do not in all cases represent the actual quantities of beets sliced, owing to inter-factory transfers.

the work increasingly difficult, and in some cases the land was so wet that it was only with the utmost difficulty that lifting could be proceeded with.

The combination of high yield and sugar content naturally gave rise to an improved return of manufactured sugar per acre, and the figure of about 2800 lbs. per acre, which is the result, again constitutes a record for this country, being over 1 cwt. higher than the previous best in 1926-27. The following table shows the yield of commercial sugar per acre since the inception of the subsidy.

Season.	Acres.	No. of Factories.	Production of Sugar. cwt.	Production of Commercial Sugar per acre of beet under cultivation lbs.
1924-25	22,441	3	478,308	2,387
1925-26	54,750	8	1,032,759	2,113
1926-27	125,814	12	3,003,933	2,674
1927-28	222,566	17	3,651,620	1,878
1928-29	175,734	18	3,874,664	2,469
1929-30	229,918	18	5,800,000*	2,800*

* Estimated.

The prices paid under the beet contract averaged about 52s. 9d. a ton, as compared with 52s. in 1928 and 55s. 6d. in 1927, the range being from 48s. 5d. to 55s. 6½d.

The standard of cultivation continues to show a steady improvement and it is reported that the crop of 1929 was generally cleaner and better cared for. Growers, generally, are displaying a keen interest and are more anxious to adopt suggestions for improvement. The crop is becoming popular with a large number of farmers, as is shown by a greatly increased acreage contracted for the 1930 season, and it seems now to have become definitely established in the farm rotation in many districts. It is noticeable, too, that farm workers are becoming more skilled in such operations as singling and hoeing. There is a growing appreciation of the value of tops and crowns as a feeding-stuff for livestock, whilst the demand for dried pulp is very keen. The total production of the latter amounted to 138,145 tons, of which 74,431 tons were molassed and 63,714 tons plain. About 6 per cent. of the dried pulp has been exported. The amount of wet pulp produced was 18,837 tons.

Beet Factory Technical Notes.

Continuous filtration.—Last campaign the makers of the well-known Philippe filter put a continuous filtering installation into the Rue factory (Somme, France) for dealing with the first or second carbonatation juice, an account of which is now given by E. SAILLARD.[1] The system comprises two distinct stages. The first takes place in a tank having the shape of an ordinary Philippe filter, but of much greater size, the frames being replaced by perforated tubes surrounded by filter-cloth. These tubes are in units of 9 to form a thickener of 33 sq. m. (355 sq. ft.) having 12 units. Each unit through the intermediary of a system of valves controlled by electromagnets, and operating alternately, is connected to two collecting tanks, one under vacuum and the other under pressure. The tank having been filled with the juice to be filtered, the vacuum operates and draws the juice from the inside to the outside of the tubes, leaving scum behind to form a layer which gradually

[1] *Suppl. Circ. hebd.*, No. 2137 of 1930.

increases in thickness until the vacuum reaches 15-20 cms. of mercury. At this moment the compressed air line operates, the deposit detaches from the cloths, and falls to the bottom of the tank. A screw conveyor placed in the bottom of the tank transforms the mixture into a semi-liquid paste of 20-24° Bé. suitable for pumping. Now the second stage commences, this consisting in a second filtration, this time through a rotary filter, the drum of which is covered with very fine gauze. The filtrate, which is a little cloudy, is returned to the thickener, while the wash-water can be sent to the lime-slaking tanks. On the whole, the writer remarks, the principle of this method of continuous filtration appears to be good; but " there are yet improvements to be made to make its application in the factory entirely conformable with the object in view."

Natural Alkalinity.—During the past year or two the determination of the point at which the second carbonatation should be stopped has been studied more intently than before.[1] It is now recognized that the presence of lime salts in the clarified juice can be controlled by stopping at what is known as the " natural alkalinity " ; and that much of the formation of scale in the evaporators can thus be prevented. SPENGLER and BRENDEL[2] have worked out the " Institute method " for ascertaining the n.a. ; but while it gives reliable results it is rather complicated, requiring for example three different standard solutions. A much simpler and more practical method is that of Duwell and Solon,[3] which is here described, after being slightly modified by the writer of this article, Dr. STILFRID BÖTTGER,[4] of Dormagen. It requires only one standard solution, details being as follows : 200 c.c. of hot juice from the first presses are heated to boiling in 600-700 c.c. Erlenmeyer flasks over a naked flame. After adding a few drops of phenolphthalein (1 : 100), CO_2 taken from the factory gas line bubbled through permanganate solution is led in until the red colour just disappears even after a further addition of the indicator. About 50 c.c. of distilled water are added ; the juice boiled for 6 min. over a naked flame ; and then filtered quantitatively through folded paper into an Erlenmeyer flask of about 1 litre capacity, the filter being twice washed with about 5 c.c. of hot distilled water. After cooling down, the whole liquid is titrated with N/5 HCl as far as neutrality to p.p., the result being calculated back to 100 c.c to obtain the practical natural final alkalinity. Then in 100 c.c. of the neutralized juice the lime content is determined with soap solution, the remainder of the neutralized liquid measured in a graduated cylinder, and the residual lime content thus calculated. In an example, 3·57 c.c. of N/5 HCl were required, so that $0{\cdot}0056 \times 3{\cdot}57 \times 2/2 = 0{\cdot}0199$ grm. CaO, say 0·02 per cent. of CaO as the practical natural residual alkalinity. In the soap test, 100 c.c. required 9·7 c.c of PELLET's soap solution (10 c.c. = 0·01 CaO), and deducting 0·1 c.c., to allow for the froth formed and referring to the table published by SPENGLER and BRENDEL,[5] one finds 9·5 mgrms. CaO ; the remainder of the liquid measured was 124 c.c., making 224 c.c. as the total neutralized liquid. Hence, $9{\cdot}5 \times 224/100 \times 2 = 10{\cdot}6$ mgrm. CaO, making the residual lime content to be 0·0106 per cent. This method, or some similar procedure giving the natural alkalinity simply and accurately, is of great interest in beet factory control, and should certainly now be adopted as a routine test.

Raw Juice Heating.—In the Frisia s.f., Holland, juice-heating has been carried out since 1923 by injecting steam into it, according to a system here described by J. HAAG.[6] Raw juice from the measuring tanks is first passed

1 *I.S.J.*, 1928, 476, 549, 600.
2 *I.S.J.*, 1928, 600.
3 *Deut. Zuckerind.*, 1929, 237.
4 *Centr. Zuckerind.*, 1930, 38, 378-379.
5 *Zeitsch. Ver. deut. Zuckerind.*, 1928, 184.
6 *Tijdschrift*, 1930, 25, No. 7, 177-191.

through an existing surface pre-heater, which is warmed with the vapour from the 4th body of the evaporator, then goes into the first and highest placed injection pre-heater, this one being warmed with vapour from the 3rd body. Thus, the juice is heated by direct contact almost to the temperature of the vapours from the 3rd body of the evaporator. Now it falls into the second injection pre-heater, which receives its vapour from the 2nd body of the evaporator through a regulating valve, and becomes heated to 94°C. And from this injection pre-heater the juice falls into a storage tank, and is pumped to the liming tanks. The working of this pump is automatically regulated in connexion with the juice level in the supply tank, so that as the juice leaves the measuring tank it is automatically pumped to the same extent into the liming tanks. It is stated that 9½ per cent. of condensed water is introduced by this system of heating into the raw juice, the density being lowered on an average from 16·6 to 15·2°Brix. This is 12·6 per cent. more water to evaporate from the juice to reach 30° Bé. as before, working 1500 metric tons of roots in 24 hours. The maximum pressure of 2 atmos. in the steam drum of the Pauly body formerly obtaining was never exceeded, varying in fact between 1·4 and 2·0 atmos., with an average of 1·69 for 30 different readings. One can thus draw the conclusion, says the author, that notwithstanding the greater evaporation of 12·6 per cent. necessitated, the capacity of the evaporators was raised to the same extent. But the coal consumption per 100 of roots sliced during the experimental period was found to be 4·67 per cent. less than when working in the ordinary way with the surface heaters, or a reduction of about 8·5 per cent. for the heating and evaporating stations alone. Moreover, it was possible to dispense with three men per shift, two for cleaning the surface heaters and one for looking after their working.

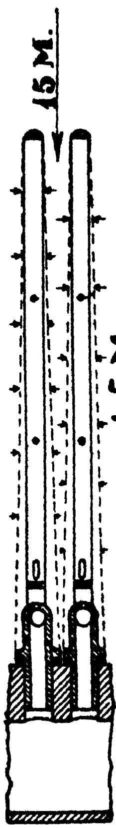
High-power centrifuging.—The progressive manager of the Tirlemont Refinery, Belgium, J. Bergé, took out a patent not long ago for a process of de-saccharifying run-off syrups, in which the syrup is spread in a thin layer over pure sugar crystals, so that on cooling and evaporating the supersaturation of the syrup occurs, and its crystallization is brought about.[1] This product is then spun in centrifugals, the power of which far exceeds that of the ordinary machine, and the crystals separated used anew for continuing the process. An exhausted molasses should thus be swung out. This invention or at least that part of it dealing with the separation of syrups by high-power centrifugals, has now been examined in the laboratory of the Sugar Experiment station, at Prague, by V. Stanek and K. Sandera.[2] A small machine having a drum of 32 cm. (12⅝ in.) radius and capable of 2500 revs. per min., corresponding to a force about 2000 times greater than gravity, was used. It was applied to two raw beet sugars with the following results :—

	Pol.	Ash.	Water.	R'ment.	Org. N.S.	Purity
Raw sugar *A*	96·1	0·80	1·57	92·1	1·53	97·8
Same, after 10 min. machining	98·3	0·43	0·57	96·2	0·70	98·8
Same, after increasing water content to 2·1, and 10 min. machining	99·1	0·28	0·50	97·7	0·12	99·5
Raw Sugar *B*	95·8	1·01	1·92	90·7	1·38	97·5
Same, after 30 min. machining	98·8	0·42	0·65	96·7	0·13	99·0

It is seen that the quality of the sugar was distinctly improved, the ash being reduced, and the rendement correspondingly increased ; secondly that the use of the small amount of 2·1 per cent. of water, about 0·5 per cent. more

1 Austrian Patent, 115, 646. 2 *Zeitsch. Zuckerind. Czechoslov.*, 1930, 54, No. 28, 305-310.

than originally present, had resulted in raising the rendement to 97·7, as compared with 92·1, the original value. Another point which was proved in these and in earlier experiments of Bergé[1] was that in thus centrifuging the ash constituents are more easily slung off, the colloid non-sugars being the more difficult to remove. Most important of all, it was shown that an affination syrup having a purity of 63·8° was separated, its amount being about 6 per cent. of the sugar. This means that by this high-power centrifuging process raw sugar can be freed from the greater part of its adhering syrup in the form of a molasses, thus opening up the possibility of eliminating an important part of the molasses from the refinery and of shortening the after-product work.



A colloid filter.—At a recent general meeting of the Dutch Society of Beet Sugar Manufacturers and Refiners, Mr. M. G. HUMMELINCK raised the question of the possible purification of raw beet juice by filtration.[2] He gave some particulars of his "colloid filter," which was originally constructed for dealing with milk. Its action depends on a totally different principle to the filters at present in use in the sugar industry.[3] These make use of cloth having holes as small as possible, so that matter in suspension is retained, and a cake is formed. No regulation of the rate of flow is necessary with ordinary Daneks, Philippes, etc. Quite different is the principle of this colloid filter, in which the filter medium is so chosen that the pores are wide enough to allow the colloidal particles easily to pass through. In order, however, to obtain a good filtration, the rate of flow must be so chosen that the filter-cloth and the film of mud forming upon it shall attract the floating particles of scum, as well as colloids. If the rate of flow is too great, no adhesion or adsorption takes place; if, on the other hand, the rate of flow is properly fixed, viz., at most 1·5 cub. m. per hour, then the filter will run for a good time. Its construction is clear from the illustration. It is like a bag filter, but the frames are set in a central conduit through which the juice enters. Its inventor is convinced that filtration through it must exercise a favourable effect in manufacture, owing to the complete separation of pulp, which at present is not effected by strainers. Hence an improvement in colour and a lowered viscosity. In cane sugar manufacture such filtration should mean the separation of the saccharetin.

Beet analysis errors.—During the preparation of the pulp for analysis, a loss of weight occurs, due to the evaporation of water from the material being subdivided. It has always been assumed that the amount of this loss on the pol. of the pulp must be inappreciable. But that it is not so is shown by results published by O. KOPECKY,[4] of the Agricultural High School, Brünn. His method of working was to cut up small lumps of beet, each about 1 grm., to weigh this rapidly in a small mortar with the pestle, to crush it to pulp, and to re-weigh. This took 3 to 5 minutes, depending on whether a fine or a coarse pulp was prepared. It was found in this way that after 3 min. only, the loss of weight averaged 1·083 per cent., which in the case of a beet of 18 per

1 *Sucr. Belge.*, 1926-27, 202.
2 *Tijdschrift*, 1929-30, **25**, No. 7, 167-173.
3 It is protected as Dutch Patent, 20,459.
4 *Zeitsch. Ver. deut. Zuckerind.*, 1930, 139-154.

cent. sucrose means an increase to 18·194 per cent., i.e., an increase practically of 0·2 per cent. After 5 minutes, the loss of water was 0·670 to 1·248 per cent., meaning that the polarization of a beet originally 18 per cent. would become 18·12 to 18·22 per cent. by the time it had been pulped. After a delay of 40 minutes, the pol. would have increased by 0·206 to 0·400 per cent. Commenting on these results, the author says that it is wrong to assume the pol. found in the pulp to be that of the original root. It would be more correct to first weigh, then pulp, instead of conversely. In general, the loss of water increases in proportion to the time, the amount of water present in the material, the fineness of the pulp, and the temperature, which in these experiments averaged 20°C. Frequently after the pulp is prepared it is set aside in the laboratory to await analysis; during the time that may elapse before it is weighed out a further appreciable loss of weight may occur, so that in the end a relatively large increase in the pol. may arise. Such a source of error must go far towards explaining the "unknown losses" of beet sugar manufacture.

MISCELLANEOUS.

Molasses analysis.—R. VAN MELCKEBEKE, President of the Belgian Commission for the Standardization of Methods for the Analysis of Molasses, published a communication[1] specifying details for the analysis of this product, of which the following is an outline: Brix, refractometrically, using MAIN's tables, and working at 20°C. Sucrose by double polarization, preliminary clarification with lead nitrate and sodium hydroxide (Herles' reagent), then both readings in the presence of the same amount of SO_2, using sodium sulphite and HCl (PELLET's method), the appropriate factor for the calculation of the sucrose being selected from HERZFELD's table, according to the concentration. Invert sugar, clarification with normal lead acetate, use of a cupro-carbonate liquor, instead of Fehling's solution, weighing the CuO, or, in routine work, estimating it by titration with permanganate. *Exhausted molasses.*—Recent theories on the formation of beet factory "final" molasses postulate that it is a stable system from which sugar can no longer be crystallized. But laboratory experiments are here described by K. SANDERA[2] in which molasses of 62° purity, believed to be uncrystallizable, was caused to crystallize by slowly concentrating it in a thin layer between two glass plates. Photographs show the microscopic crystals in the film around the edges of the plates. Dr. O. SPENGLER, of the Berlin Institute, tells the authors in a private communication that it is his opinion that the purity of even invert-free beet molasses can be lowered to 40°. Hence the possibility that by improving after-product work the yield of sugar may be raised. *A new decolorizing carbon.*—Decolorizing carbons are being used in a number of beet houses in Czecho-slovakia for refining, and here K. REICH and G. VAVRINECZ[3] give an account of comparative large-scale tests with "Norit Superior" and the new "Anticarbon-NOO." As regards rate of filtration, the figures for 1st liquors were Norit : Acticarbon 45 : 55; and for 2nd liquors, 49 : 51. Decolorizing results are given for the kg. of "Fuska" units adsorbed by 1 quintal of the carbon, Norit taking up 2·857, and Acticarbon, 4·105.

NEW SWEETENING AGENT.—A new synthetic sweetening agent, namely, the syn isomer of 5-benzyl-2 furfuraldoxim, has been prepared by Gilmann and Dickey, of Iowa State College, from maize residues. This material is slightly soluble in water. It is stated to be 700 times as sweet as cane sugar, saccharin being 550 times.

1 *Sucr. Belge*, 1930, 49, No. 15, 282-289.
2 *Zeitsch. Zuckerind. Czecho-slov.*, 1930, 54, No. 31, 333-338.
3 *Zeitsch. Zuckerind. Czecho-slov.*, 1920, 54, No. 31, 338-339.

The Teatini Process.

A New Process for the Purification of Beet Sugar.

At the recent annual general meeting of the Société Technique et Chimique de Sucrerie de Belgique, held at Brussels on the 21st May, 1930, M. TEATINI the manager of a larger group of Belgian sugar factories described at some length his new process for the purification of beet sugar juices.

In view of the importance of the results which TEATINI has obtained from two campaigns actual working in the factory we propose to deal with the more salient features in his paper. (*Sucrerie Belge*, xlix, 1930, p. 563).

TEATINI first stresses the great influence which the juice clarification exerts on the different stages of manufacture, the concentration of juice and

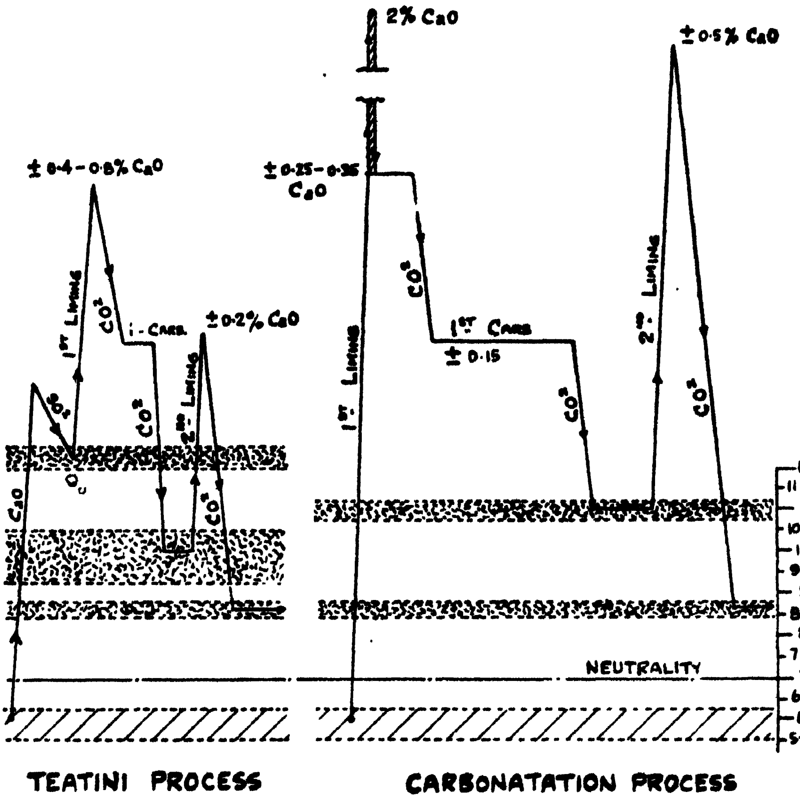


FIG. 1.

the volume of massecuite, exhaustion of the molasses, the recovery, and the cost and the quality of the finished sugar. After the nature of the various non-sugars has been described, he discusses the various aspects of the ordinary carbonatation system as now practised. including the chemical and physical chemical processes during defecation and saturation.

Whatever may be the chemical and other phenomena which take place during the carbonatation process, industrial experience has shown that with a very high outlay of CaO there is eliminated only about 45 per cent. of the non-sugars contained in the raw juice, though this figure varies between certain limits according to the factory and the year. In the ± 55 per cent. of

FIG. 2. Colloids in Diffusion Juice.

non-sugars remaining in the purified juice, the mineral matter represents about 33 per cent. and the organic matter about 67 per cent. These figures prove the importance and the inadquate nature of the organic purification of the juices.

The enormously important rôle which is played by colloidal substances in clarification has now been universally recognized, and TEATINI accordingly performed a series of researches using the ultramicroscope for the examination of the juices, etc. Ultramicroscopic photographs revealed surprisingly little difference in colloid content (as shown in Figs. 2, 3 and 5) between the raw diffusion juice and the juice clarified by double carbonatation, even though the latter appears to the eye to be bright and clear.

TEATINI investigated the action of certain electrolytes on diffusion juice previously limed to a predetermined point, since it is certain that the isoelectric zone of the beet juice colloids lies well towards the alkaline side. Sulphurous acid (derived from cylinders of liquid SO_2) was finally proved to be the most effective electrolyte for neutralizing the charge on the juice colloids and thereby effecting their precipitation. Furthermore, the precipitated $CaSO_3$ needles form nuclei to which the colloidal particles attach themselves. The quantity of CaO necessary in the process varies according to the raw juice acidity and is composed of two fractions :

FIG. 3. Colloids in Thin-juice filtered and clarified by carbonatation process.

(1) CaO required to neutralize the acidity of the juice, about 0·05 per cent. to 0·1 per cent.

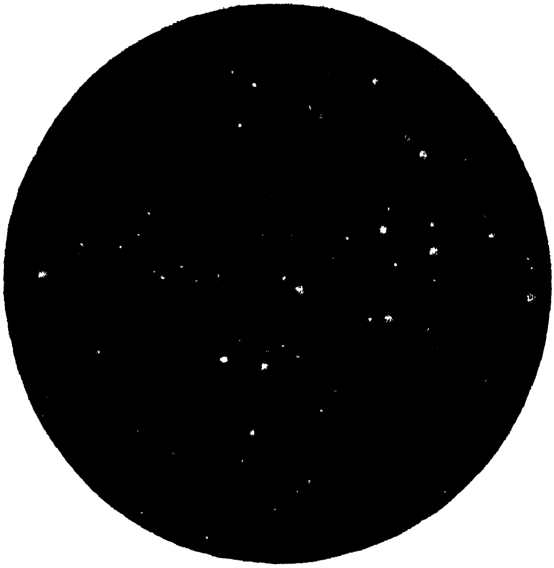


FIG. 4. Colloids in Thin-juice filtered and clarified by Teatini Process.

(2) CaO, corresponding to the quantity necessary for saturation at the usual temperature, this amount generally being 0·40 per cent.

The small first fraction of lime is not obtained by the direct introduction of lime into juice but by adding to the hot (85°C) acid raw juice (*pH* 6) a sufficient quantity of previously limed juice. This operation is realised in a simple manner by leaving in the liming tanks (see Fig. 7) a fraction of the limed juice from the preceding operation. The alkalinity at this stage is thus very exactly and easily regulated and has a well defined optimum value. Immediately after this preliminary liming, the liquid SO_2 is introduced from the tank or cylinder (Fig. 7), being measured in a special form of apparatus designed by TEATINI. In this device, which is termed the "Sulphitometer," the operations are all carried out by moving a single lever which the operator places in the filling or emptying position. The glass measuring cylinder is filled completely with the liquid SO_2 at every operation (one measure per liming tank), the exact volume being conveniently adjusted periodically by the introduction or withdrawal of glass balls in the cylinder. The quantity of liquid SO_2 averages 100 gr. per ton of beet and the cost is negligible. The addition of the SO_2 lowers the *pH* to the isoelectric point round *pH* 12, and there is an excellent and rapid settling of the flocs, due partly to the speed with which the liquid SO_2 penetrates the main body of the juice, for the speed with which an electro-

FIG. 5. Colloids in Molasses from Carbonatation Process.

lyte is added greatly influences the result in colloidal precipitation in general. After adding the SO_2 the juice receives a certain quantity of lime averaging 0·75 (minimum of 0·45 per cent.) and is then pumped to the continuous carbonatation tanks where the saturation is controlled by the electric conductivity method. A diagrammatic comparison between the successive operations of the ordinary carbonatation and of the TEATINI process is shown in Fig. 1. Carbonatation is very rapid and this has an important effect on the subsequent filtration (CLAASSEN). The first carbonatation filters work very easily and the filtering area has been reduced by 45 per cent. since the introduction of the process. The cakes are greenish in colour and have a very much lower specific gravity than those obtained in the ordinary process, and furthermore they constitute excellent fertilizer, owing to the much higher per cent. of nitrogen and relatively lower per cent. of $CaCO_3$. They are easy to sweeten-off and the sugar loss in cake has been reduced to the low figure of 0·03 per cent. beet. The Teatini process also involves a reduction in the factory process water and therefore advantageously affects the effluent.

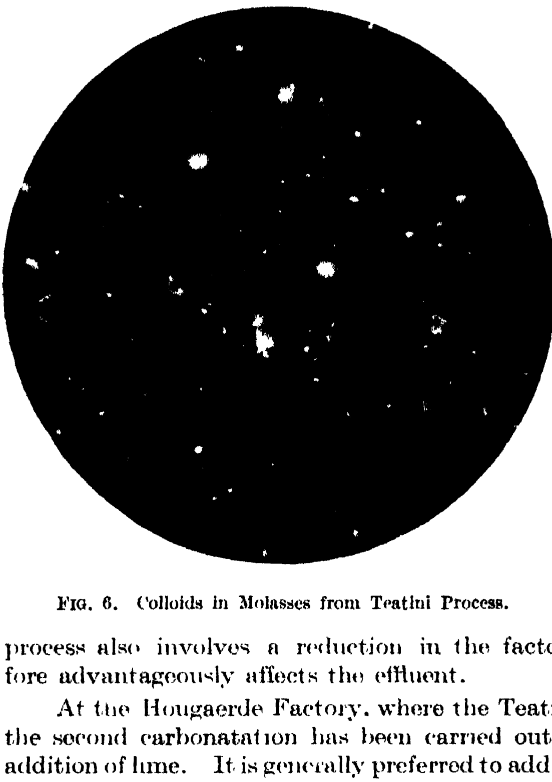


FIG. 6. Colloids in Molasses from Teatini Process.

At the Hougaerde Factory, where the Teatini Process has been applied, the second carbonatation has been carried out both with and without the addition of lime. It is generally preferred to add a trace of lime, the maximum being 0·2 per cent. CaO. The second carbonatation is carried to an alkalinity of approximately 0·01 and the thin-juice is not subsequently sulphured. The extensive removal of colloids by the Teatini Process is well illustrated in Figs. 4 and 6.

The increase in colour on evaporation, as well as the absolute colour of the syrup, is much less by the Teatini Process than by the ordinary process, partly due to the strong reducing action of the sulphites on the raw juice in the early stages, which as STANEK and VONDRAK have shown, prevents the formation of colour during the evaporation, and the earlier the sulphites are introduced the better so that they can act on the oxidases, etc.

The syrups filter much more readily and about 60 per cent. of the syrup filters have been eliminated at Hougaerde; and a most important point is the very much greater rapidity of boiling of the massecuites. The massecuites furthermore spin so well that the capacity of the centrifugal station has been increased 50 to 60 per cent. The run-offs are less viscous than those obtained by the carbonatation process and need not be diluted, sulphured or filtered.

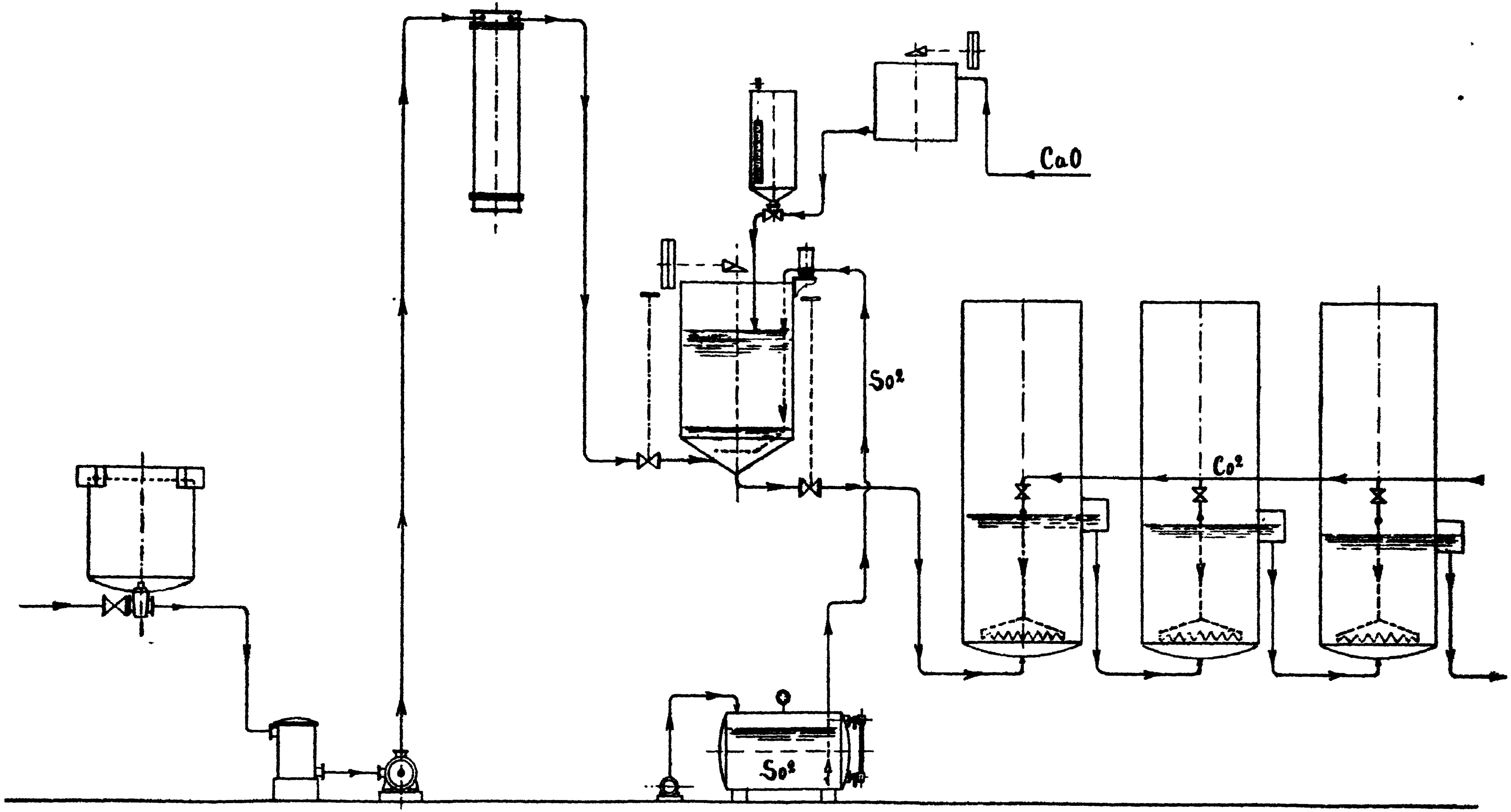


FIG. 7. Industrial Application of the Testini Process.

Owing to the greater elimination of colloidal and colouring matter, less washing and remeltings are involved, which materially reduces the re-circulation of sugar solids. Thus the quantity of first massecuite has been substantially reduced by the new process and savings have been made in fuel. Considerably less scaling has been noticed in the juice-heaters, and the evaporator has worked the whole campaign without being cleaned.

The molasses production at Hougaerde No. II Factory, working with the TEATINI process, is consistently 0·5 per cent. lower (on beets) than at the No. 1 factory, situated alongside and working identical beets, but with the ordinary carbonatation process, using about 2·5 per cent. lime.

The capacity of the No. II factory has been increased from 1200 tons of beet to 1500 tons of beet per day entirely by the new process, and with no additional plant, in fact the process has rendered certain plant unnecessary.

TEATINI remarks that whatever may be the explanation or the scientific interpretations that may be given to the various phenomena which he has recorded, nothing will alter the results actually obtained industrially during the manufacture of 12,000 tons of white sugar, which are summarized thus :—

(1) Large reduction in the consumption of CaO, which is reduced to about 0·7 per cent. average.

(2) A solution of the problem of filtering lightly limed liquors.

(3) Large reductions in the dilution of the juices due to the addition of less milk-of-lime.

(4) Increase in capacity of the factory.

(5) Improvement in purification, and generally improved working at all stations subsequent to diffusion.

(6) Reduced sugar losses.

(7) Large reduction in material (coke, coal, filter-cloths) for a larger output of the factory, also the abolishment of part of the carbonatation heaters, filter-presses, mechanical filters, centrifugals.

(8) Reduced scale formation in heaters, evaporators, etc.

(9) Production of muds, much richer in fertilizing value.

We understand that under Belgian conditions the savings realized at the Hougaerde factory have approximated to at least Frs. 18·60 per ton of beet. (2s. 1d.).

Under English conditions with a higher price for sugar and greater cost for limestone and labour, the savings should be proportionately greater.

It is possible that the Teatini process will also find application in those *cane sugar* factories employing carbonatation, especially where limestone costs are high, as in South Africa, India, etc..

Patents covering the Teatini process have already been granted in Belgium (367,847 ; 367,848 and 367,849) and have been applied for in the principal countries.

Renold Chains.

A new chain clutch has been specially designed by Messrs. Hans Renold, Ltd., of Manchester, for association with their standard stock chain drives. These clutches, though on an entirely new principle, are extremely simple in construction, efficient and cheap to install; they provide an equivalent of the fast and loose pulley for chain drives; are capable of quick or gradual engagement; have no springs or linings and will run in oil. Booklet 016/15 of this firm gives full particulars of the clutch.

Correspondence.

THE INTERNATIONAL SOCIETY OF SUGAR CANE TECHNOLOGISTS.

TO THE EDITOR OF THE "INTERNATIONAL SUGAR JOURNAL."

DEAR SIR,—I was surprised to read in the issue of *Facts about Sugar* for June, 1930, that it had been decided, temporarily at least, to make that publication the official organ of the "International Association of Sugar Cane Technologists."

Without in any way deprecating the standing of that journal it appears to me that this action is hardly justifiable, and bears unfairly on other journals of equal standing.

The journal of which you, Sir, are Editor has had a long and not unworthy career; and its columns present a continuous record of the technical development of the cane sugar industry, extending over sixty years.

At the very least it is due to your journal that it be included amongst those which may give expression to technical developments in the cane sugar industry; and, as a member of the International Congress, I feel called upon to dissent from the adopted policy of restriction to one and one only publication.

NOEL DEERR.

RESTRICTING THE MILLING OPERATION.

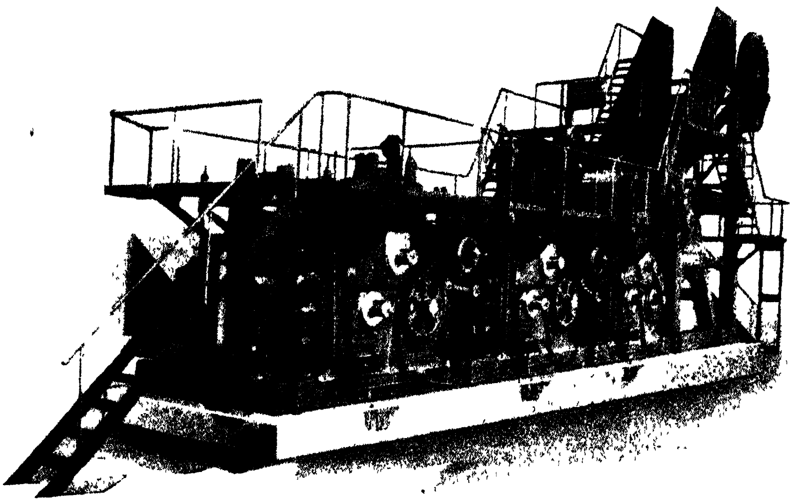
TO THE EDITOR OF THE "INTERNATIONAL SUGAR JOURNAL."

SIR,—I have read Dr. MAXWELL'S suggested remedy for overproduction of sugar in the March number of your Journal, just received, and however well we may all agree in the abstract, with his suggestion to abandon the portion of sugar most costly to extract, it is not a suggestion that commends itself to all sugar producing countries alike.

Taking Brazil, for instance, where alcohol is an important article of use (and there are surely others), though the world's market prices only interest it when owing to unexpectedly good crops there is a surplus and home prices fall below the cost of production as at present, I have frequently recommended to add an extra mill, not to obtain extra sugar, but by adding a maximum quantity of water for imbibition, or preferably maceration, before entering that mill, to obtain maximum extraction, possibly total, and send the sweet-water obtained to the distillery for use in setting up wash instead of a corresponding amount of fresh water. About 33 per cent. added water on the volume of natural juice would, at a rough calculation, give the required amount for the wash.

I do not suppose that every sugar exporting country has a sufficient home consumption for all the alcohol it could so produce—some of them might look into it and see why—but there must be many who can use large quantities as motor fuel, alcohol simply of say 96° such as any good modern still can produce, acid free, and bar the noxious ingredients that governments think it necessary to add to it. Here about 80 per cent. of the motor cars and practically all the lorries use alcohol simply, a small proportion using it mixed with ether. With a 14 h.p. Ford, with a "hot-plate" to the carburetter heating the already mixed charge, I use about 20 per cent. more alcohol than petrol, and the cost is less than one-half. Alcohol lighting, first introduced at the end of last century into Brazil, is still much used where electricity is unobtainable. Alcohol stationary engines (Crossley's) were introduced at the

FARREL



Farrel Mill and Crusher

The above 32 in. × 66 in. nine roller mill and 36 in. × 66 in. two roll crusher is of the latest Farrel design and is complete with intermediate carriers, cane chute, platforms, railings, etc. This unit complete with its drive, engine, juice strainer, revolving cane knives, etc., etc., was completely assembled before being shipped. The Farrel Plant is adequately equipped with all the modern facilities for the prompt and careful manufacture of up-to-date sugar machinery.

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beginning of this century and took the place of oil in many small installations, not requiring frequent cleaning as with the latter ; once a year was the rule.

With the growing use of CO_2 for " dry-ice " and refrigeration generally and with the by-products of the lees, from the yeast to acetic acid, acetone, cyanides, potash, etc., I can imagine a further source of profit from that portion of the sugar not made into board-stuff, or burnt in the furnaces.

As a large part of the bagasse must still go for fuel, those of us who have for long years been pointing out to our friends the iniquity of making steam with sugar will now have to do a right-about turn and extol the merits of bad crushing. The United States is a large producer of petrol, and turns out also large quantities of alcohol motor fuel. England does not produce petrol in any great quantity from native oils and no alcohol motor fuel. Why not ?

ALFRED J. WATTS.

Pernambuco,
April 12th, 1930.

The Cuban Market for Agricultural Implements.

(American Consular Report.)

American agricultural implements are well received in Cuba, and foreign competition is negligible. Apparently, it is limited to steam cable ploughs of which a few are imported from England. Some middle breakers for furrowing cane fields are imported from Germany, but, on the whole, American manufacturers are firmly entrenched in the market. However, local dealers look to a more decided bid on the part of European manufacturers for a share of this business as soon as the economic situation improves.

During 1929, American implement shipments to Cuba amounted to \$1,159,825 as compared with \$812,367 in 1928—a satisfactory increase in the face of the rather poor economic condition of the plants. During 1929, the equipment consisted chiefly of tractors, cultivating implements such as ploughs, harrows, and the like, with a fairly large amount of dairy equipment.

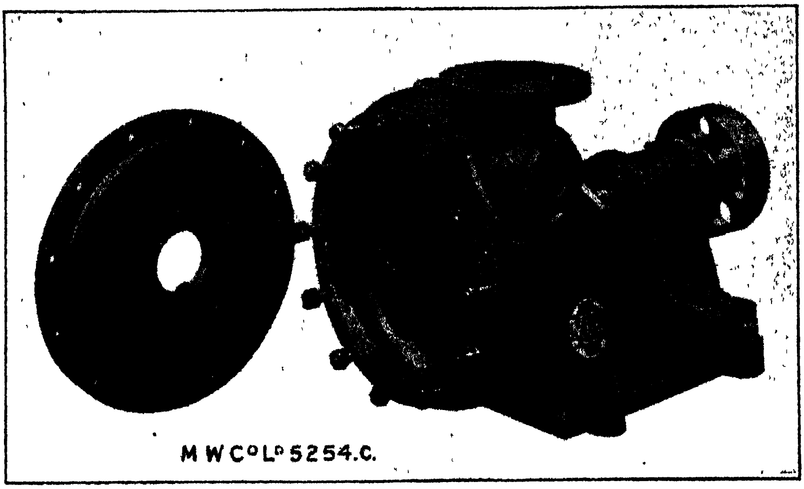
According to Cuban statistics covering implements released during 1928, Germany and the United Kingdom are the principal competitors of the United States in the implement field, but the volume of business done by these two countries is so small as to be negligible when compared with the volume done by American manufacturers. In fact, much of the German business consisted of trade in knives, machetes, and other such hand tools, which are not thought of as agricultural implements by Americans.

Walking ploughs, tractor ploughs, tractors, both wheel and track-laying, subsoilers, disc harrows and cultivators, and mowers for cleaning the fields are heavy sellers in the sugar industry. Tracklaying tractors seem to be in greater demand, as it is claimed that this type can be used the year round for ploughing and cane hauling, while wheel tractors are handicapped during the rainy season.

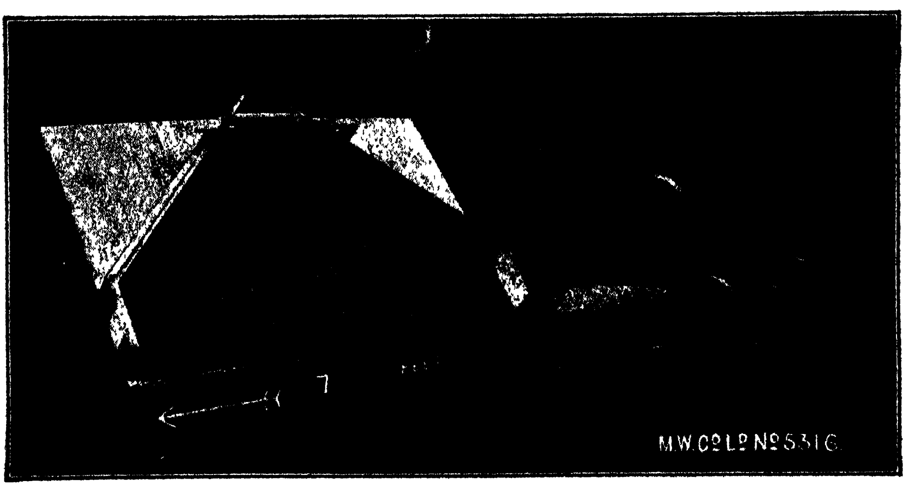
Cane planting and cutting are still done almost exclusively by hand. Cane planting and cutting machines, of which several have been invented, are getting beyond the experimental stage and, theoretically at least, are claimed to be successful. However, their introduction has been retarded by two main factors—first, their high initial cost as compared with the low wages paid to manual labour in the fields, and secondly, the fact that in the past most of the cane has been planted without taking into consideration the possibility of harvesting by machinery. In new plantings more attention is being given to the preparation of cane fields, which practice has resulted in a heavy demand for stump pullers, and will tend to permit the use of machinery for harvesting purposes.

"Chokeless" Pumps for Unstrained Juices.

The Mirrlees Watson Co., Ltd., of Glasgow, are marketing a "Chokeless" Pump for the return of unstrained juices used for imbibition in cane milling plants, which are already in successful operation in a number of factories in Cuba, including Delicias, Senado and Hormiguero, as well as in Trinidad and in Africa. This pump is intended to eliminate the "cush-cush" or bagacillo strainer and



elevator in a cane mill, since it is now possible to operate a satisfactory return imbibition system in large milling plants without the strainer. In the most simple form of compound imbibition, all imbibition water is sprayed on the blanket of bagasse going to the last mill. The weak juice from both rollers of the last mill passes by a single gutter directly to a Mirrlees "Chokeless" centrifugal pump,



Distributor.

and is returned with all suspended "cush-cush" to the blanket of bagasse entering the preceding mill. As it is impossible to regulate the suction or discharge of a "Chokeless" pump by a valve (bagasse would very quickly accumulate and choke it), a very effective regulation is obtained by fitting an air cock in the taper suction connexion to the pump and regulating the amount of air the pump can

draw through this connexion. The discharge from the pump is led to a very simple distributing device which is easily adjustable for all normal rates of flow of juice. Further particulars of the advantages of the system can be obtained from the makers. This system of return imbibition is covered by Cuban Patent No. 8986.

Publications Received.

Activated Carbon: The Modern Purifier. By C. L. Mantell, Ph.D.; with the co-operation of the Technical Staff of the Industrial Chemical Sales Co., Inc. (Obtainable from British Suchar Processes, Ltd., 16, Abbey House, 2, Victoria Street, London, S.W. 1). 1930. Free on application.

This is a booklet setting forth in an attractive way salient information on activated carbon in general, and on "NuChar," one of the best known marks on the market, in particular. It describes the origin and characteristics of this material, and the adsorption principle to which it owes its effect. It describes its application in industries, showing the numerous uses to which it may profitably be put, as in the refining of sugar, and the production of glycerin, vinegar, gelatin, drugs and pharmaceuticals, organic solvents, and an important application other than sugar refining is that of decolorizing and deodorizing oils of various kinds. Activated carbon has been found of value in the purification of water, chlorine being added in excess, and the carbon added to de-chlorinate and further purify. "NuChar" is now produced in six standard qualities, the selection of which is dictated by the nature of the material under treatment and by the economic factor. "NuChar-OOO" and "NuChar-XXX" are qualities of exceedingly high power offered for the solution of the most stubborn bleaching problems. Those interested in decolorizing carbon should secure this well-written booklet, the author of which recently published a textbook on the subject of industrial carbon,[1] which was well received.

Korte Handleiding tot de Fabrikatie van Suiker uit Suikerriet op Java en in Suriname. By Dr. H. C. Prinsen Geerligs. Fifth, revised and enlarged edition. (J. H. de Bussy, Amsterdam). 1930.

This is the abbreviated edition of Dr. GEERLIGS' "De Fabricatie van Suiker uit Suikerriet." It forms the best possible introductory textbook for the Dutch student taking up sugar production as his career. Indeed one is impressed with the great amount of salient information its author is able to compress into a comparatively small space. This last edition of the "Korte Handleiding" is now brought quite up-to-date, and one finds additions referring the reader to recent developments, such as *pH* control, BRENDEL's brasmoscope, BARTSCH's directions to be followed in the absence of boiling control apparatus, the LAFEUILLE crystallizer, and the utilization of bagasse for making boarding.

Heat Transfer and Crystallization. W. L. McCabe. Article IX; Theory of Industrial Crystallization. (Swenson Evpaorator Co., of Harvey, Ill., U.S.A.). 1930.

Contents: Importance of crystal size; crystallization theory; nucleus formation; and crystal growth. An illustration is given on the back of this bulletin of the Swenson-Walker continuous crystallizer.

Die Russisch-Ukrainische Zuckerindustrie seit dem Weltkriege (1914-1930). Ewsey Rabinovitsch. (Ost-Europa-Verlags, Berlin). 1930. Price: Rm. 7.50.

Chapters: The sugar industry and Russian political economy; the World War and the sugar industry; the agrarian revolution and the sugar industry; industrial organization and its results; some economical view-points; and final words.

[1] *I.S.J.*, 1929, 217.

Brevities.

Petree Process.—A recent advertisement states: "To produce a pound of raw sugar for less money the sugar mill operator must simplify processes; he must handle greater tonnages of cane with his present equipment; he must reduce sugar losses; he must reduce the number of man-hours per bag; he must eliminate maintenance of obsolete equipment; he must lessen the amount paid for miscellaneous materials; he must cut his fuel expenses. All these things which the present economic situation demands that he must do, he can do by the use of the Petree Process."

Refining by "Sumacarb."—This is a British decolorizing carbon which tests have shown to have a decolorizing power equal to that of any other carbon on the market. A process has been worked out by means of which any raw factory can turn out a part of its production as refined granulated for local consumption or export. No special plant is required, and revivification is unnecessary. This simple refining process has now definitely been established as practicable and economical, being in continuous operation in several factory-refineries in different countries.

Cuban Sugar for Russia.—After negotiations extending over several months the sale to Russia is announced of about 135,000 tons of Cuban sugar at 1·56 cents per lb. f.o.b. It would appear that the sugar was bought by the Soviet through the medium of a London broker and is to be financed under the British Government's export credit scheme. For the transaction some 130,000 tons of refined made from Cuban raws were ordered from Messrs. Tate & Lyle, who in consequence have been able fully to employ their Greenock and Liverpool factories. According to one Havana report, the price ex Cuba was 1·35 cents.

New Suchar Refinery.—In conjunction with the raw sugar plant of the Central Luzon Milling Co., Bamban, Tarlac, P.I., a Suchar refinery, owned by the Insular Sugar Refining Co., started up in December last. Its capacity is 150 tons of refined per day. Washing is carried out with two 40 in. Hepworth self-discharging centrifugals, electrically driven, and four "Auto" filters are used for the carbon filtration and for sweetening off the carbon. Boiling is done in two calandria pans, 8 ft. 6 in. dia.; and the white sugar is purged in three 40 in. flat-bottom centrifugals. Revivification is carried out in the special furnace of the Sugar Process Corporation, being thus restored to its full efficiency for re-use in the process. The refinery is electrically driven throughout, and its steam requirements can be supplied either by excess bagasse from the central, or by oil. J. C. Mahoney is superintendent.

Caroni Sugar Estates.—The Annual Report of the Caroni Sugar Estates (Trinidad) Ltd. for the year ending December last shows that the net profit was only £14,572 (against £22,141), which with the balance carried forward from 1928 makes a total at credit of Profit and Loss of £39,385. The value of sugar in the world's market being now well below the cost of production in every country and the outlook for this important industry in the British West Indies being fraught with uncertainty, the directors are obliged to continue the policy of conserving the financial resources of the company; the above total of £39,385 is therefore carried forward. The dividend on the 7½ per cent. preference shares is in arrear from July, 1925, and no dividend has yet been paid on the ordinary shares. The 1929 crop constituted a record at 12,338 tons; that for 1930 is unlikely to exceed 9,500 tons owing to adverse weather conditions.

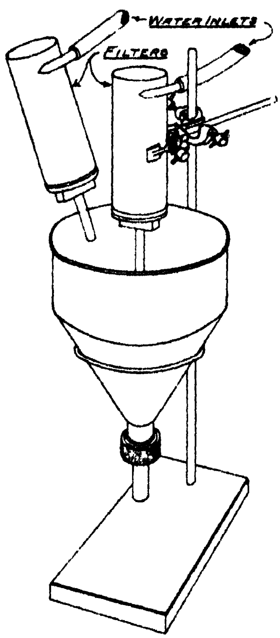
The Maxwell Shredder.—According to the Java "Molencontrole," 1st-16th August, 1929, the present milling plant of the s.f. Poppoh consists of a Maxwell crusher-shredder (30 in. × 60 in.) and *four* mills (32 in. × 72 in.). This installation has achieved the best milling result of all factories in Java using common imbibition, irrespective of the number and size of units in the milling trains. Its result is better than the *best* obtained by all the factories with crusher and *five* mills; also better than that obtained by the only factory with *six* mills, or than that of the only factory with crusher and *six* mills. This remarkable record was achieved by the use of only 18 per cent. of imbibition applied in the ordinary way. Conclusion: The Maxwell Shredder fixed to any crusher cuts out one mill, irrespective of number of mills in the train. Milling in Java is gauged by "lost juice per cent. fibre." This figure for Poppoh is 23; the best of all factories with crusher and five mills is 24.[1]

[1] Data from a recent advertisement.

Review of Current Technical Literature.[1]

SEPARATION OF COARSE PARTICLES FROM FINE POWDERS (E.G., KIESELGUHR). **G. Gallie and B. D. Porritt.**[2] *Transactions of the Institution of the Rubber Industry*, **1926, 2, 116.**

Even the finest powders are liable to contamination by coarse matter; and, though the proportion of this may be small, its effect may be serious, especially if it is in the form of "grit." Two obvious methods have been used for the detection of such coarse matter or grit: (1) to rub a small amount with oil between two glass plates (a qualitative test only); or to sieve a known quantity through a fine mesh, weighing the residue. But hand sieving is subject to inaccuracies, since firstly wire gauze is far from being a uniform material; secondly, the openings tend to become clogged with particles; and, thirdly, aggregates are estimated as grit, whereas in use they would break down. If the aggregates are rubbed down, the result largely depends on the individual operating. Therefore, some method is demanded which shall obviate possibilities of irregular results, and this is now provided by the use of the apparatus here illustrated.[3] In short the device consists of a metal funnel, in the outlet of which is placed a small disc (say 25 mm. diam.) of wire gauze of any desired mesh, the gauze being actually contained in a removable cup.



A weighed portion of the sample of the powder under examination is placed in the funnel, and a jet of water directed upon it. Actually (as is seen) there are two jets, the high pressure jet and the secondary jet, and the procedure in making a test is as follows: The material on the funnel is thoroughly wetted by a stream of water from the secondary supply, this being continued until the funnel is about half filled with liquid. Then the high pressure jet is slowly turned on, and the position of the nozzle under the liquid adjusted in relation to the sieve until there is little or no disturbance on the surface and the level of liquid is sinking. Now the secondary supply is brought into use to maintain a constant level, and to wash down material on the sides. When the residual matter on the disc has been thoroughly washed for a definite time, the water is turned off, and the grit washed down into the cup, which is removed. Lastly the grit is transferred to an oven, dried and weighed. This method has been found to satisfy all the requirements which it was designed to meet. It enables tests to be carried out quickly, the results are constant, and the size of the openings of the miniature sieve can be easily checked, either by microscopic examination, or by projection on a screen for direct measurement.

ECONOMICAL RUNNING OF MULTITUBULAR BOILER PLANT. **J. E. Bihl.** *Proceedings of the Annual Congress, South African Sugar Technologists' Association*, 1929.

Recording instruments and careful logging of details is essential; steam flow indicators are necessary to show the work the boilers are doing; steam recording charts should be used; CO_2 and recorders are essential to check the combustion of each boiler. It is only with the assistance of such instruments that accurate data can be collected as a guide to efficiency. *Firing.*—Owing to the rigid design of multitubular boilers, it is necessary to raise steam very slowly, two to three weeks

[1] This Review is copyright, and no part of it may be reproduced without permission.—Editors, *I.S.J.*

[2] Director, Research Association of British Rubber and Tyre Manufacturers, London.

[3] This method has come largely into use in different industries, being found to give readily reproducible results. It has been adopted by large refineries in the U.K. as a method for controlling the amount of "grit" in kieselguhr.

being taken to heat up a battery from dead cold. It is a serious loss of heat to commence turning on steam half-an-hour before crushing commences, but it is absolutely essential to heat up slowly to avoid sudden changes in temperature, leaky joints, water-hammer, and perhaps serious damage. About half-an-hour before crushing commences the main stop valve of each boiler is "eased off" its seat very slowly to heat up the main steam ranges, commencing of course with the boiler having the highest temperature after having ascertained that every steam drain is open. Every engine and pump is also heated up, and provision is likewise made to heat up the exhaust range. The steam drains must be left open and only shut off on each steam range as the units on that particular range are started. The auxiliary engines and necessary pumps should all be working before the mill engines are started up. It is then unnecessary to run the mills idle for more than a few minutes. If possible never use cold feed water, especially when starting up; and there are times when it should most certainly receive chemical treatment. Regular water feeding is as important as regular firing, and a reliable feed water regulator would be a very desirable fitting.

Draught.—This is a very difficult problem. Each boiler should be regulated by means of its damper, the extent being determined from the CO_2 analysis of the flue gases. Fuel permitting, the draught should be kept at almost its maximum, and the thickness of fuel maintained by close regulation of feed. To get a good combustion with 12 to 14 per cent. of CO_2 at the boiler damper requires constant care and supervision, and the quantity of bagasse to be fixed for each boiler is obviously dependent on the size of bagasse and prevailing conditions. *Cleaning.*—Methodical and proper cleaning of fires is essential for good burning of bagasse, and when so doing the dampers should be almost shut to prevent undue cooling and stressing of tubes. When using river water, boilers should be blown down normally every 8 hours, and more frequently when a change of water occurs. In washing out boilers, a powerful stream of water from a hose should be used when the boiler is hot, and from the top as well as the bottom manhole. Radiation and condensation losses should be reduced to a minimum and steam leaks should be regarded as sources of deliberate waste if allowed to remain week after week. Water drops from leaky flanges cause a large steam loss; whilst that due to unlagged steam piping has not generally received the attention that it should. *General remarks.*—It is conducive to economy and efficiency to have the boiler-room practice as uniform as possible in all respects. Approved routine should be established in the room, and when this is done the work will go on almost automatically. A competent person should inspect the boilers regularly, especially at week-ends when boilers are being washed out. Heat is an invisible intangible thing, but its generation costs money. Waste, therefore, should not be tolerated.

Making Plantation White at Central Providencia, Cuba. **Tiburcio Irazoqui.** *Proceedings of the Third Annual Conference of the Association of Sugar Technologists of Cuba*, 1929.

Central Providencia, Guines, Cuba, has specialized for years past in meeting the needs of the Havana market by delivering consumption sugars of high quality for use by the confectionery, fruit preserving, and soft drink industries, and to a lesser degree for direct consumption. But of late in place of a refined grade it has been turning out "extra turbinated, of quite a white colour," and polarizing 99·7°, this being made in the following manner: Limed juice after passing through heaters is raised to boiling point in defecators, left to settle for an hour, and evaporated in a quintuple in the usual way. A small copper vacuum pan is used for producing the crystals serving as *pied-de-cuite* for the different strikes. It is charged with evaporator syrup, and a few moments before crystallization sodium hydrosulphite solution is added. Three calandria pans are used for producing the turbinated sugar strikes from this *pied-de-cuite*, being boiled to 92° Brix. Here again, a few minutes before closing the steam valves, sodium hydrosulphite is drawn in at the rate of 1 kilo per 20 tons of massecuite, this producing a remarkable decolorizing effect. Strikes are emptied into a closed crystallizer feeding the centrifugals, where the crystals are

washed to dryness with superheated steam, and finally washed with blue solution. Sugar thus obtained amounts to 40 per cent. of the total production, the remainder being raw of 96·5 to 97°. Green and wash syrups coming from the turbinated sugar strikes have purities of 65 to 70°, and have a slightly acid reaction as the result of the addition of the hydrosulphite, so before drawing them into the second strikes they are diluted to 28° Bé., and neutralized with carbonate of soda. At the Central Providencia liming tanks, defecators, supply tanks crystallizers, etc., are enamelled to avoid contact as far as possible with iron.

VARIOUS SPECIAL PIECES OF FACTORY EQUIPMENT (MITCHELL SCREEN, HUMMER SCREEN, MACERATION BATH, OLIVER FILTER, MEINECKE CHUTE). *Proceedings of the Annual Congress of the South African Sugar Technologists' Association.*

Mitchell Screen.—It is an electrically vibrating screen driven by a motor to suit customers' requirements, its vibrations being 60 per sec. in a circular movement of about $\frac{1}{16}$ in. in diam. It has a rated capacity of 500 gall. per min., and requires about $\frac{3}{4}$ H.P. The results of a trial at Central Hormiguero, Cuba, were so satisfactory that three more installations were ordered for the following crop. At first an 80-mesh screen was used, but later a 60 and finally a 40 was used, the material being phosphor-bronze. When the screen had become clogged after 9-10 days, it was immersed in 1 per cent. potash for 15 hours, being after washing ready for use again. *Hummer Screen.*—It is recognized that by straining the juice much more efficiently than is possible by the usual "cush-cush" straining apparatus a large amount of substance can be removed that otherwise might interfere with filtration and might also affect the recovery of sugar. This can be done by the Vibrating Screen, a rival of the Peck strainer. It is already in use with excellent results in different sugar producing countries. including Natal and Zululand. *Maceration Bath.*—This is an innovation in Natal, having been adopted by the Natal Estates, Ltd., though long in use in Australia. Chief factors in its operation are : time, heat and total immersion in a large percentage of maceration water. It has been used at Mt. Edgecombe between the 4th and 5th mills, and has in conjunction with the 5th mill increased the extraction at that estate from 90 to 94 per cent.

Oliver Filter.—Mr. VIGER, of Tinley Manor, Natal, where this filter has been in operation, reports that, though not in a position to compare its costs against those of the plate-and-frame, it can safely be said that a substantial saving in labour and filter-cloths is obtained, besides which an increased recovery of sugar results. There are a great number of advantages in this continuous filter, the most important being its "fool-proof" operation. Its efficiency is almost entirely free from the personal equation of the workman, who has nothing to do with the time of filtration, with the extent of the washing cycle, or with the pressure during transference of liquors, the universal valve doing everything for him automatically. Labour saving, or better labour productivity, is here practically a maximum, and a battery of machines can be attended by one man only for the discharge of immense tonnages. Weak points relating to this filter are firstly the greater water content of the cake discharged. viz. about 70 against 60 per cent. in the plate-and-frame-press (the respective sucrose contents being 2·5 and 5·8 per cent.). Secondly, there is the flat grinding valve, corrosion and erosion making the use of ground disc valves poor practice at the best. *Meinecke Chute.*—Mr. HERRISON, Chief Engineer at Central Verulam, reported that one was installed between his third and fourth mills and was in operation for three weeks with fair results. Results were not perfect, the main trouble being that the chute would not feed the following mill regularly. There was a tendency to break up the blanket into lumps of various sizes which caused the mill to slip and choke. Naturally, as results were not satisfactory, the chute was taken out and the slat carrier was installed. His personal opinion is that the Meinecke would work well with mills of short centres and soft canes of low fibre percentage. But with a hard cane of high fibre, such as Uba, a well designed scraper type intermediate carrier will take some beating.

VALUE OF SURFACE TENSION DETERMINATIONS. **K. Sandera and R. Sigmund.** *Zeitsch. Zuckerind. Czechoslov.*, 1930, **54**, No. 29, 317-323. Determinations of the s.t. of beet factory and refinery products lead the authors to conclude that the colloids in certain very pure solutions may correspond with the s.t.; but that this is only so under entirely identical ideal conditions. Thus, the presence of insignificant traces of fat (even ten-thousandths of a per cent.), such as are frequently present in beet factory juices, completely vitiate the results.—ULTRA-VIOLET RAYS FOR THE EXAMINATION OF SUGAR. Anon. *Centr. Zuckerind.*, 1930, **38**, No. 17, 484-485. During recent years so-called fluorescence analysis has developed considerably, and the significance in examining sugars by ultra-violet light has been studied by H. LUNDEN.[1] By mixing sugars with impurities in varying amount, it is possible to construct a "fluorescence scale" which is well suited for judging the quality of sugars. Variations corresponding to 0·001 per cent. of ash may thus be detected. The difference between refined and beet white sugars (containing 0·05 per cent. of ash) is very marked. Extremely small amounts of colouring matter in solutions of white sugars can thus be shown up. An apparatus equipped with suitable ray filters is here described, the cost of which is relatively moderate.—LIQUID SUGAR: HANDLING AND STORING. Anon. *Leaflets 2, 3 and 4, issued by Lamborn & Co., Inc., New York.* A few more details of the advantages to confectioners, jam manufacturers, and others, of buying sugar from the refiner in the form of heavy liquor.[2] Ordinary dry sugar must be moved by hand labour from the storage room to the required point in the plant, often on an upper floor. But liquid sugar is delivered by tank wagons from which it is pumped to suitable tanks in the plant, from which tanks it flows by gravity to the spot required. On turning on a valve, the sugar is immediately at hand without extra handling, as in the case of ordinary dry sugar. Regarding storage, liquid sugar can be contained in a tank placed in a part of the building otherwise waste space.—DETERMINATION OF SUGAR IN BAGASSE IN JAVA. **E. T. Westly.** *Proceedings of the 7th Annual Convention of the Philippine Sugar Association*, 1929. Following his "Annual Synopsis of Philippine Mill Data." already reported,[3] Mr. WESTLY made the following remarks: In general, the methods of laboratory control in vogue in Java are excellent and the Dutch are no doubt very up-to-date in their methods of control. However, I do think that the method determining the polarization of the bagasse probably results in too low a figure and hence the actual extraction obtained in Java is probably somewhat less than their reported figure. The practice in vogue in Java is to take one kilo of bagasse in ten litres of water. This mixture is boiled for one hour in a closed vessel with a condenser on top. No sodium carbonate is added to the mixture. I think this method of digesting the bagasse very likely results in too low a figure for polarization."—HISTORY OF VACUUM DRYING. **E. Passburg.** *Chem. Fabr.*, 1930, 93-95. An interesting review by an achnowledged authority on this subject. He mentions that the first vacuum dryer was an experimental one erected in 1881 in St. Petersburg for drying sugar containing 3-4 per cent. of water, after which the author applied apparatus on this principle to the products of different chemical industries.—REPORT ON CHEMICAL METHODS FOR REDUCING SUGARS. **R. F. Jackson.** *Journal of the A.O.A.C.*, 1930, **13**, No. 2, 197-201. MUNSON and WALKER in their well-known method omitted giving the copper equivalents for levulose. In preliminary experiments made by the author to supply these, it was apparent that the reducing ratio is a function of the concentration of sugar. If it is assumed that the reducing power of a sugar mixture is an additive property of the constituents, the ratios of invert sugar to dextrose can be extrapolated to those of levulose to dextrose. But a comparison of those extrapolated with the experimental ratios reveals a serious discrepancy. Either the rule of mixtures is inaccurate, or some error exists in the experimental data. Such error may occur either in the present data for levulose, or in MUNSON and WALKER's values for invert sugar. It is the purpose of the author to conduct further tests using pure levulose to seek the source of this discrepancy.

J. P. O.

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[1] *I.S.J.*, 1925, 614. [2] *I.S.J.*, 1930, 154. [3] *I.S.J.*, 1930, 214.

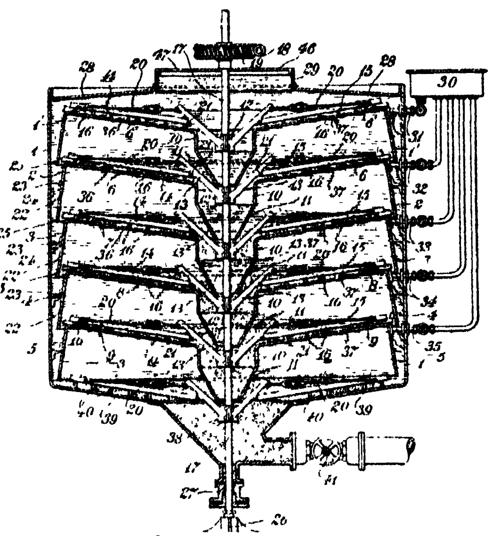
Review of Recent Patents.[1]

UNITED STATES.

Separation of Finely Divided Solids from Liquids (Juice Clarification).

John W. Wickes, of Tongaat, Natal. 1,754,870. April 15th, 1930.

Apparatus for the separation of finely divided solids from liquids comprises a tank containing a plurality of superposed bells, the skirts of which are spaced apart, the central portion of each bell being provided with an opening so as to permit of the radial outward flow of the liquid introduced into the tank toward the wall thereof, thus producing a parallel flow of the deposited matter and of the clear liquid. An object of the present invention is to provide the separation of finely divided solids from liquids in a more efficient manner than heretofore, whilst minimizing the possibility of the solids and clear liquid mixing; and further to provide an apparatus in which the flow of raw liquid is in a direction opposite to that of the flow of the clear liquid to zones from which the said clear liquid may be tapped to the exterior of the apparatus. Raw liquid may be introduced to the vat or tank through the opening 47 or through an opening provided in the wall of the tank or through an opening provided in the cover adjacent to the wall of the tank. In the figure assuming that raw liquid is introduced through the opening 47, such raw liquid if the tank be empty strikes against the top of the uppermost bell and is deflected therefrom through the central depending annuli to the bottom of the tank or vat. Assuming, however, that the tank is partly filled with raw liquid, and that it be desired to admit further raw liquid through the opening 47, the additional raw liquid on striking the surface of the liquid already in the vat being of greater specific gravity would tend to collect towards the centre of the tank and the inwardly inclined tops of the bells would facilitate this tendency and the additional raw liquid would therefore tend to pass downwardly through the central annuli to the bottom of the tank or vat. The sweep mechanism is intended to sweep the sediment towards the central depending annuli so that the raw liquid will tend to gravitate by reason of its greater specific gravity towards the bottom of the tank through the central depending annuli. As such raw liquid is more or less saturated with solids in suspension, such solids therefore will tend to form a continuous column centrally through the superposed bells. If, however, the raw liquid be delivered peripherally of the vat, then the continuous column tends to form between the skirts of the bells and the wall of the tank.



By means of the construction of apparatus as hereinbefore described, a continuous column of sediment may be obtained, the weight of which aids in its consolidation. Further, it permits of the sediment from the various settling areas being conveyed to the bottom of the vat by passages which are separate and distinct from those through which the raw material enters the underside of a bell or the under-

[1] Copies of specifications of patents with their drawings can be obtained on application to the following—*United Kingdom*: Patent Office, Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2 (price 1s. each). Abstracts of United Kingdom patents marked in our Review with a star (*) are reproduced from the *Illustrated Official Journal (Patents)*, with the permission of the Controller of H.M. Stationery Office, London. Sometimes only the drawing or drawings are so reproduced. *United States*: Commissioner of Patents, Washington, D.C. (price 10 cents each). *France*: L'Imprimerie Nationale, 87, rue Vieille, du Temple, Paris. *Germany*: Patentamt, Berlin, Germany.

sides of the bells, and the continuous column of sediment assists by reason of its own weight and head in the production of a heavy precipitate in the bottom sediment-receiving chamber. Apparatus in accordance with the present invention provides for a considerable head of precipitate with a comparatively small amount of sediment in storage, and the use of bell-settling areas for the collection of the clear liquid gives protection in the clear liquid zones from disturbing currents. The bell-type of collector provides a quiescent zone in which the clear liquid is secured free from any disturbing currents that might be caused in the main body of the vat or tank by the incoming raw material. The bell-type of apparatus allows of the scrapers or sweepers being designed if so desired to over-run the top edges of the bells both centrally and peripherally, thereby permitting of the surfaces of the bell tops being kept clean. The amount of clear liquid abstracted from each bell may be controlled or regulated in many well known ways such as by means of valves or by adjustable weir overflows from the various supply pipes to a common receiving tank. Claim : The herein described method of separating finely divided solids from liquids which consists in introducing liquid carrying solids in suspension into the upper part of a chamber, constraining the said liquid to flow vertically downward through a plurality of chambers superposed therein, withdrawing clear liquid from the highest zone of the superposed chambers, thereby causing a slow movement of the clear liquid towards the said highest zones and discharging sediment which has settled on the tops of the superposed chambers in a direction to promote the slow movement of the clear liquid drawn from the said highest zones.

DEFECATION OF JUICE (CANE OR BEET). **Arthur W. Bull** (assignor to **The Dorr Co.**, of New York). 1,752,781. April 1st, 1930.

In the ordinary defecation operation by lime the solids formed chemically, together with albumin coagulated by the heat, tend to form large flocs which settle promptly and rapidly, thereby removing readily from the juice a great majority of the settlable solids. However, the very rapidity with which the flocs settle tends to leave in suspension a residuum of fine solids which are too disperse to form flocs, and which therefore settle quite slowly. This condition requires the use of settling tanks of sufficient size to remove the finer solids, or else demands additional filtration or other special treatment. The general object of this invention is to control the sedimentation process in such a way that substantially all of the settlable solids will be aggregated into flocs, and will be removed with corresponding rapidity by the settlement of the flocs. This is accomplished by employing carefully regulated agitation which will be sufficient to prevent the settling of the flocs to any great extent ; since it has been found that for some reason as yet unknown, after the flocs have been broken up it is impossible to reproduce them of the same size as those originally formed. By maintaining an even distribution of the forming flocs throughout the juice all of the fine solids have an opportunity to attach themselves to the flocs ; and after a sufficient period of agitation the juice is run into a settling tank where the flocs settle out rapidly, having a clear supernatant juice. It should be noted that while the agitation of the juice with reagents for defecating purposes is not new, such agitation heretofore has been carried on simply for the purpose of assuring complete mixing of the reagent with the juice, without considering the effect on floc formation. Such mixing would therefore be inadequate to produce the substantially complete accumulation of the solids in flocs of maximum size, according to the present invention. The apparatus comprises a settling tank divided by transverse trays into a plurality of superposed settling compartments each provided with overflow or decantation pipes having inlet sections and outlet section passing through the walls of tank and into overflow box in well known manner as employed in the standard Dorr clarifier. The solids settling on each tray and on the bottom of the tank may be propelled to the centre by revolving rake arms. The solids settling in the bottom compartment are withdrawn through the central discharge opening through pipe connecting with a pump. The agitator for the feed comprising the juice with defecating agents may be located directly above the centre of the settling apparatus, and preferably is mounted directly on the top of the uppermost compartment. The feed is introduced through

a suitable pipe and the scum launder extends radially across the agitator with its edge just above the liquid level in the agitation compartment and passing through a wall for discharge of scum and floating matter. Means may be provided for returning to the feed a portion of the settled solids or mud. Claim 2 : In a process of manufacturing sugar in which the sugar-bearing juice is treated to precipitate impurities, the step which comprises the continuous preparation of the treated juice for sedimentation by agitating a continuously flowing stream of juice during a detention period between the influx and the discharge of the juice sufficient to obtain substantially complete floculation in the effluent and at a rate adequate to maintain a substantially uniform suspension of all flocs in all portions of the juice which have been subjected to the agitation for substantially the same period of time, but insufficient to prevent the formation and maintenance of flocs of substantially maximum size in any part of the juice undergoing continuous agitation.

BONEBLACK. **Edouard Urbain** (assignor to the **Urbain Corporation,** a Corporation of Delaware). 1,755,156. April 15th, 1930. A process of producing boneblack of great decolorizing power comprises the steps of treating pieces of bone with acid under conditions adapted to remove calcium carbonate from such pieces without causing them to disintegrate, and therafter calcining the residue of such pieces.—GLUTAMINIC ACID. **Karl Bromig** (assignor to **Deutsche Gold & Silber Scheideanstalt, vorm. Roessler,** of Frankfort-on-the-Main. Germany). 1,755,683. April 22nd, 1930. A process for preparation of glutaminic acid from sugar residues comprises treating the starting material with hot concentrated hydrochloric acid, separating the hot solution from any deposited solids, cooling and again removing deposited solids, concentrating the solution, cooling to low temperature and saturating with hydrochloric acid gas whereby glutaminic acid hydrochloride separates out on standing.—CLARIFICATION PROCESS. **Arthur W. Bull** (assignor to **The Dorr Co.,** of New York). 1,755,165. April 22nd, 1930. The method of treating beet juice in the manufacture of sugar which comprises mixing raw juice with carbonated juice is claimed.—BEET BLOCKER. **Hesiquio Becerra,** of Cheyenne, Wyo, U.S.A. 1,755,861. April 22nd, 1930. An agricultural machine comprises a rectangular frame, an extension laterally projecting from one side thereof, supporting wheels for said frame and extension respectively, cross bars included in said frame, bearings carried by said cross bars, a plurality of shafts of different lengths mounted on some of said bearings and having their forward ends arranged in horizontal stepped relation with respect to each other, shafts journalled in the remaining bearings and in parallelism with the shafts first mentioned, means for driving the last mentioned shafts from the driving wheels of the frame, means for driving the first mentioned shafts from the other shafts, means for varying the speed of the last mentioned shafts, discs secured on the last mentioned shafts and on the ends thereof that are disposed in horizontal stepped relation with respect to each other, adjustable crank means carried by said sides, arms pivotally secured to the adjustable crank means, depending means pivotally secured to said arms, and hoe shovels adjustably connected to said arms.—CANE CUTTER. **Masaichi Sasaki,** of Lihue, T.H. 1,756,664. April 29th, 1930. A crawling cane attachment of the class described includes in combination, a frame structure for attachment to a tractor, a transverse bar, means for attaching the bar to the frame structure, a transverse shaft, means for journalling the transverse shaft to the frame structure in front of the bar, a plurality of pairs of bars rockable on the shaft and having elongated loop members receiving the transverse bar, the forward ends of each pair of bars having spaced parallel extensions, a chain and sprocket mechanism between each pair of extensions, sprockets of the mechanism being fixed to the shaft, knives projecting from the chain.—BEET TOPPER. **Carl A. J. Andersen,** of Salt Lake City, Utah. 1,752,285. April 1st, 1930. Claim is made for a beet topper comprising a wheel-supported frame, an axle on which the rear portion of said frame is supported, a sprocket wheel secured on said axle, vertical standards secured to the front portion of said frame, a shaft journalled in said vertical standards, a sprocket wheel carried on said shaft, a sprocket chain carried on said sprocket wheel, a belt tightener frame supported on said standards, a shaft journalled in said

tightener frame, and movable in arc-shaped slots cut in said vertical standards, means to impart motion from the first-mentioned shaft to the last-mentioned shaft, slotted standards secured to said frame, a shaft journalled near the rear portion of the said frame and adapted to move vertically in said slots, topper beam through which the last-mentioned shaft is passed, and which shaft and beam move vertically up and down, springs to control the movement of said beam, a topping blade secured on the lower end of said beam, spaced apart sprocket wheels carried on said last-mentioned shaft, a pair of spaced apart sprocket wheels carried on the shaft which is in said tightener frame, spaced apart foliage chains over said last-mentioned pairs of sprocket wheels to impart rotation thereto, said chains having blades secured thereto having teeth on the outer side thereof, and means to raise and lower said beam.

UNITED KINGDOM.

FILM EVAPORATOR.* **Chemische Fabrik J. Bellak,** of Vienna, Austria (communicated by **H. Wade,** London). 326,510. December 14th, 1928.

In evaporators of the type in which the liquid to be evaporated or concentrated trickles down over steam-heated tubes, the total heating surface of the tubes decreases in successive horizontal rows of tubes or in successive groups of such rows from the highest row downwards. A multiple effect evaporator comprises three similar elements 1, 2 and 3. In each element the number of tubes in each horizontal row decreases from four at the top to two and then to one at the bottom. Liquid to be evaporated is fed on to tubes 5 from feeding devices consisting of pipes 28 provided each with a longitudinal slot into which a bar 30 of wedge-shaped section can be moved, to adjust the flow. The liquid dripping off the tubes is caught by trays 26 and conducted on to the next group of tubes, from which trays 25 or 15' conduct in to the last group of tubes. The concentrated liquid passes by a duct 43 to a receptacle 44.

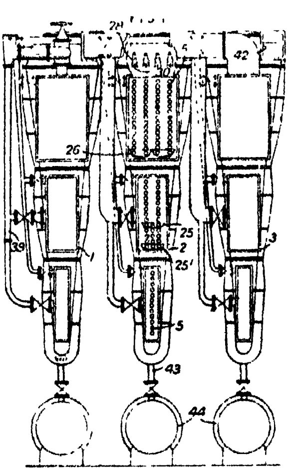
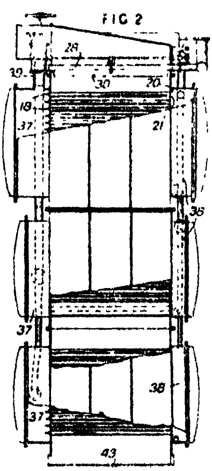


FIG 2



Steam is supplied to all the tubes of the first element in parallel by a supply pipe 39, communicating with chambers 27; after passing though the tubes the air and residual steam is removed from the chambers 38 by a suction duct. The steam produced in the first evaporating element passes through the tubes of the second element, and so on, in the known manner. The evaporating chamber of the third element is connected to a condenser by a pipe 42. Each heating tube 5 is provided with a throttle valve 18 at the steam entry, and with outlets 20, 21, for air and condensate respectively at the other end. Claim 1 : Evaporator with steam heated tubes on which the liquid to be concentrated is drizzling, characterized by the feature, that the total heating surface of the tubes decreases in successive horizontal rows of tubes or in successive groups of such rows from the highest row downward. (2) Evaporator as set forth in Claim 1, characterized by the feature that horizontal tube rows of equal numbers of tubes are united in groups and that the number of tubes in the horizontal rows of the single groups decreases from top to bottom. [It is stated for this evaporator that it is specially suited for use in the sugar industry ; and that it can show efficiency figures especially in respect of steam consumption more favourable than other types of apparatus. Its cost of construction is stated to be lower than for the standard type at present mostly in use.]

FILTER FOR COLLOID LIQUIDS. **Marius G. W. Hummelinck**, of Vlaardingen, Holland. 291,810. December, 1926.

The present invention principally consists of a process for purifying liquids which contain colloids or coarser dispersions or the like by means of filtration characterized by the feature that the liquid to be filtered is passed through a filter cloth or wire mesh, the pores of which are wide compared with the size of the colloidal, emulsified or suspended particles, the flow of the liquid being regulated in such a way that the liquid passes into and through the filtering layer with a velocity not exceeding 1·8 meters per hour and so that the deposit of impurities is not disturbed by the movement of the liquid. In order to distinguish this method of filtration from ordinary filtration it will be referred to herein as physical filtration. The invention is based on the surprising discovery, that the impurities in the said liquids may very nearly completely be deposited on the filtering material by leading these liquids through the pores or meshes of a thin layer of filtering material under special circumstances which are now described hereinafter. The principal conditions, which should be fulfilled in order to attain the purpose of the invention are : (1) That the liquid to be purified is passed quietly through and along the filtering surface. (2) That the size of the pores is adapted to the size of the particles which it is desired to pass into the filtrate. Such constructions may be realised in many ways. Principally speaking a filtering apparatus in which the above conditions are fulfilled comprises a container, one part of which acts as a receptacle for the liquid to be filtered and to which the liquid is supplied from outside, another part of the said container being provided with suitable horizontal or vertical filtering elements which discharge the purified liquid outside the said receptacle. It should be understood, that the discharge-tubes or other similar device may be positioned either at the top or at the bottom of the said container or of the part containing the filtering elements. Claim is : A process for removing impurities from colloidal liquids, emulsions or suspensions by means of filtration, characterized by the feature that the liquid to be filtered is passed through a filter-cloth or wire mesh, the pores of which are wide compared with the size of the colloidal, emulsified or suspended articles, the flow of the liquid being regulated in such a way that the liquid passes into and through the filtering layer with a velocity which does not exceed 1·8 metres per hour and so that the deposit of impurities is not disturbed by the movement of the liquid.

EVAPORATOR. **Chemische Fabrik J. Bellak.** 326,510. December 14th, 1928. This specification relates to evaporators of the type in which the liquid to be evaporated or concentrated trickles down over steam-heated tubes, the total heating surface of the tubes decreases in successive horizontal rows of tubes or in successive groups of such rows from the highest row downwards.—BEET TOPPER. **W. T. Cook**, of Yaxley, Peterborough. 326,639. February 20th, 1929. An auxiliary frame carrying an angularly disposed rotary cutter and a positioning roller is secured at its rear end by a pivot to the main frame from which its forward end is supported by a spring and slotted links. The roller as it rides over the beets lifts the auxiliary frame and thus positions the knife for the cut. A plate deflects the cut tops to the side of the machine.—SYNTHESIS OF SUGARS. **J. Y. Johnson (I. G. Farbenindustrie A.-G.**, of Frankfort-on-Main). 327,193. December 3rd, 1928. Formaldehyde, or a polymer thereof, is heated with a catalyst in the presence of a mono- or polyhydric alcohol miscible with water. The sugar is obtained in the form of a clear syrup by separating the catalyst and evaporating the solvent. An example is given in which equal parts by weight of a 30 per cent. aqueous solution of formaldehyde and methyl alcohol are boiled for 10 hours in the presence of lead oxide as catalyst. In further examples, trioxymethylene is condensed, in the presence of glycerol and lead oxide, and formaldehyde is condensed in the presence of methyl alcohol and lime. The sugars obtained may be subjected to a catalytic reduction for the production of polyhydric alcohols ; in an example, the sugar is diluted to a 10 per cent. aqueous solution and treated with hydrogen in the presence of a platinum catalyst. The product contains considerable quantities of glycerol besides other polyhydric alcohols. (Specifications 309,200 and 311,788 are referred to).—WRAPPING CUBE SUGAR. **G. Fairrie, A. Fairrie and Fairrie & Co., Ltd.**, of Liverpool. 328,446. April 30th, 1929. Relates to a method of wrapping lumps of sugar so as to form an elongated packet with a projecting tab. (Specification 199,176 is referred to).

United Kingdom.

IMPORTS AND EXPORTS OF SUGAR.

IMPORTS.

	One Month ending June 30th.		Six Months ending June 30th.	
Unrefined Sugars.	1929. Tons.	1930. Tons.	1929. Tons.	1930. Tons.
Poland	....	9,330	38,667	24,435
Germany	4,075	11,983	26,889	37,541
Netherlands	....	....	....	....
France	....	....	....	....
Czecho-Slovakia	4,838	....	16,690	508
Java	....	....	79,112	2
Philippine Islands	....	....	....	....
Cuba	66,380	102,624	284,714	278,200
Dutch Guiana	....	....	....	....
Hayti and San Domingo	32,200	22,956	125,899	150,305
Mexico	....	....	....	....
Peru	2,552	3,485	66,719	42,307
Brazil	292	3,846	11,527	40,290
Union of South Africa	....	728	17,685	15,407
Mauritius	4,488	758	166,810	79,446
Australia	....	1	95,884	69,727
Straits Settlements	....	....	....	....
British West Indies, British Guiana & British Honduras	28,170	18,149	64,011	52,912
Other Countries	1,042	3,607	17,824	27,921
Total Raw Sugars	**144,037**	**177,468**	**1,012,430**	**819,002**
Refined Sugars.				
Poland	....	....	....	....
Germany	340	383	469	798
Netherlands	983	961	8,950	5,223
Belgium	134	127	686	453
France	....	....	....	....
Czecho-Slovakia	2,835	4,840	13,911	15,862
Java	....	....	....	....
United States of America	929	1,278	4,477	5,496
Canada	....	1	7	2
Other Countries	39	1	65	484
Total Refined Sugars	**5,261**	**7,591**	**28,564**	**28,317**
Molasses { Foreign	17,232	13,057	102,458	143,867
Molasses { British	9,165	4,145	32,364	12,953
Total Imports	**175,695**	**202,261**	**1,175,816**	**1,004,139**

EXPORTS.

British Refined Sugars.	Tons.	Tons.	Tons.	Tons.
Denmark	111	52	595	307
Netherlands	....	..	...	....
Irish Free State	3,865	3,629	24,202	21,213
Channel Islands	71	40	524	924
British West Africa	137	121	1,378	957
Canada	....	....	....	....
Other Countries	1,761	8,904	65,397	79,863
	5,945	12,747	92,096	103,264
Foreign & Colonial Sugars.				
Refined and Candy	156	309	825	1,309
Unrefined	191	44	432	330
Various Mixed in Bond	....	....	....	....
Molasses	572	65	5,492	558
Total Exports	**6,864**	**13,165**	**98,845**	**105,461**

United States.

(*Willett & Gray.*)

(Total of 2,240 lbs.)	1930. Tons.		1929. Tons.
Total Receipts, Jan. 1st to June 28th	1,306,176	..	2,089,236
Deliveries " "	1,554,835	..	1,797,947
Meltings by Refiners " "	1,474,357	..	1,579,400
Exports of Refined " "	19,300	..	51,000
Importers' Stocks, June 28th	188,612	..	389,520
Total Stocks, June 28th	428,684	..	672,791
	1929.		1928.
Total Consumption for twelve months	5,810,980	..	5,542,636

Cuba.

STATEMENT OF EXPORTS AND STOCKS OF SUGAR, AT MAY 31ST.

(Tons of 2,240 lbs.)	1928. Tons.		1929. Tons.		1930. Tons.
Exports	1,610,606	..	2,445,303	..	981,266
Stocks	1,270,621	..	1,439,050	..	1,701,274
	2,881,227	..	3,884,353	..	2,682,540
Local Consumption	41,924	..	31,181	..	26,411
Receipts at Ports to May 31st ..	2,923,151	..	3,915,534	..	2,708,951

Habana, May 31*st*, 1930. J. GUMA.—L. MEJER

United Kingdom.

STATEMENT OF IMPORTS, EXPORTS, AND CONSUMPTION OF FOREIGN SUGAR FOR SIX MONTHS ENDING JUNE 30TH, 1928, 1929, AND 1930.

IMPORTS.	1928. Tons.	1929. Tons.	1930. Tons.	EXPORTS (Foreign).	1928. Tons.	1929. Tons.	1930. Tons.
Refined .	169,616	28,564	28,317	Refined ...	443	825	1,309
Raw	876,900	1,012,430	819,002	Raw	459	432	330
Molasses ...	119,182	134,822	156,820	Molasses .	3,415	5,492	558
	1,165,698	1,175,816	1,004,139		4,317	6,749	2,197

HOME CONSUMPTION OF IMPORTED SUGAR.

	1928. Tons.		1929. Tons.		1930. Tons.
Refined	160,551	..	28,818	..	26,079
*Refined (in Bond) in the United Kingdom	325,400	..	360		707
†Raw	351,600	.	995,940	..	925,523
Total of Sugar	837,551	..	1,025,119	..	952,309
Molasses	3,351	..	5,096	..	3,958
Molasses, manufactured (in Bond) in United Kingdom ..	31,068	..	1	.	6
	871,970		1,030,216		956,273

STOCKS IN BOND IN THE CUSTOMS WAREHOUSES OR ENTERED TO BE WAREHOUSED AT JUNE 30TH.

	1928. Tons.		1929. Tons.		1930. Tons.
Manufactured from Home Grown Beet	14,800	..	15,350	..	15,500
Refined in Bond	31,700	..	8,350	..	1,450
Foreign Refined	30,050	..	10,400	..	7,800
" Unrefined	235,750	..	122,900	..	160,000
	312,300		157,000		184,750

* The quantities here shown are exclusive of the deliveries of refined sugar which has been produced from duty-paid sugar returned to refineries to be again refined. Sugar refineries ceased working in Bond as from 25th April, 1928.

† The quantities here shown include 169,570 tons entered for refining in refineries in the month ended 30th June, 1930, and 871,179 tons in the six months ended 30th June, 1930.

United Kingdom Monthly Sugar Report.

Our last report was dated 10th June, 1930.

The trade depression that is passing over the world at the present moment has not left sugar alone, and has added to the already difficult position of the article.

Prices have been depressed throughout the period under review and fresh low levels have been established for all classes of sugar. The price of Raws fell in New York to 1·25 and Cubans were heavy sellers on the New York Exchange, which has fallen about 20 points.

The rumours concerning a Conference between European countries and Cuba and Java have so far not materialized.

Russia has bought a further 50,000 tons, but this time direct from Cuba to Odessa and not via the British Refiners.

The Terminal Markets in London have been flat and the whole market is 9d. to 10½d. lower since our last report. The August liquidation has been in full swing for the past few weeks and this month fell from 6s. 3d. to 5s. 4½d. Large quantities of Mauritius were hedged on December and this month fell from 6s. 8¼d. to 5s. 9¾d March fell in sympathy from 7s. 9d. to 6s. 9¾d. and May from 8s. to 7s. 1½d. The latest prices are :—

	AUGUST		DECEMBER		MARCH		MAY
Raw	6s. 4½d.	..	6s. 9d.	..	6s. 10½d.	..	7s. 1½d.
White	8s. 1½d.	..	8s. 6¾d.	..	—	..	—

The trade have not been very much interested and there has been little change in price in Refiners and Home Grown Factories. The Refiners advanced their price by 3d. on the 16th June and since then there has been no change. The latest prices are. London Granulated 21s. 7½d., No. 1 Cubes, 25s. 3d.

Business in Raws has not been so active and the Refiners have only bought sparingly. July Cubans sold from 6s. 9d. to 6s. 4½d. and a parcel afloat sold at 6s. 3d., whilst October shipments sold at 6s. 8¼d to 6s. 6d. c.i.f.

There is no fresh news from Europe except that it is reported that the weather is too dry in Poland and Czecho-Slovakia, but other countries appear to have had sufficient rain.

The Cuban crop appears to have finished with a production of 4,670,000 tons and the stock in the island to-day is slightly under 3,000,000 tons.

21, Mincing Lane,
London, E.C.3.
9th July, 1930.

ARTHUR B. HODGE,
Sugar Merchants and Brokers.

THE

INTERNATIONAL SUGAR JOURNAL.

☞ All communications to be addressed to "The International Sugar Journal," 2, St. Dunstan's Hill, London, E.C. 3.

☞ The Editors are not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

No. 380. AUGUST, 1930. VOL. XXXII.

Notes and Comments.

The Outlook.

There is no change in the general depression. To quote a leading authority, Messrs. CZARNIKOW, "the tone of the markets has been so demoralized that it is impossible to foretell events from day to day. It becomes more and more evident, however, that discouraging as the outlook is, the statistical position is now no longer the controlling factor in the trend of prices, and it would certainly seem reasonable to assert that the present level cannot be justified by any logical argument and that prices have become a prey to the acute depression into which the commodity has fallen." A price of a little more than one halfpenny per lb., f.o.b. cannot persist indefinitely, but the price factor is not alone sufficient to bring about a return of confidence. For that we must seek elsewhere, but who knows whither to turn for a solution ?

Sugar of course is only one of several commodities which are suffering from excessive low prices in world markets, but when, as has been pointed out, 88 per cent. beet is selling for less per cwt. than are English potatoes, or horse feed in the form of hay and oats, then one may well pray for a speedy solution of the mystery. But if sugar is the most price-depressed of all the sufferers, it would seem that it possesses, in theory at least, the quickest road to recovery once the broken down machine can be got going. Mr. GOLODETZ continues to attach some importance to the relative position of "visibles" and "invisibles." According to him, we are now and have been for some time past travelling in the direction of steadily decreased invisible stocks and increasing invisible consumption. Such movements cannot be directly proved and their existence is at best only an impression, based on trained observation. But if this view of invisibles is correct, then conditions must necessarily be better than they look from the statistics. There must be an irreducible minimum of invisible supplies, and when that point is reached, a marked inroad on visible supplies should in theory result.

There is nothing to report in the matter of international negotiations ; informal pourparlers continue and though they lead to no practicable agreement, it is nowhere suggested that the attempt to find a solution is being abandoned for good. The depression in the industry is a powerful factor in inducing the parties to continue "exploring avenues." Our Cuban corres-

pondent gives some details of a fresh attempt at co-operation in Cuba which may or may not lead to something so far as the Cuban crop is concerned. It is clear that this island cannot continue indefinitely over-producing and then selling under cost price.

LORD OLIVIER, since his return from the West Indies, has given the Labour Government in this country no rest in the matter of the plight to which our West Indian sugar industry has been brought; and his last attack in the House of Lords on July 30th brought from LORD PASSFIELD, the Colonial Secretary, the important admission that while they could not induce the Chancellor of the Exchequer, Mr. SNOWDEN, to say that he would never touch the sugar duty, yet since it brought in some 12 millions sterling a year, the prospect of sparing this sum in the next Budget, or the one after, either, was too small to make it likely that the sugar duty would be abolished within the next two years. This means, in effect, that the sugar preference is fairly certain to continue for that period, and so one great factor of uncertainty for the West Indies is set at rest.

The Trend of Politics in England.

Since sugar, as we have remarked on more than one previous occasion, is the shuttlecock of English politicians and has been interfered with by them to a greater extent than any other article of food or drink in the last fifty years, the trend of politics at home is not a matter to which the sugar industry in the British realms can be indifferent; as a matter of fact Imperial sugar interests are probably now more concerned with what happens politically in the Mother country than at any previous epoch. For these reasons it may be relevant at this juncture to take a brief survey of the present political situation.

England as the home of free trade has clung for a century to a doctrine involving the free exchange of commodities. Originally the principle suited her well as she was the leading manufacturing country of the world and needed to exchange these manufactures for food; the original apostles of free trade, moreover, had such faith in the soundness of their doctrine that they fondly believed the rest of the world would follow suit. Unfortunately for the free traders it did not; the rest of the world with a few trifling exceptions took slowly but surely to a policy of protection, under which manufacturing industries were started in these other countries and their local needs in manufactured goods gradually more or less met. When the stage arrived where they were fully met, the country concerned started to export, and the free market of the United Kingdom soon became the natural destination. Gradually free trade so far as this country was concerned became increasingly a matter of "free imports." The "free exports," meeting an increasing wall of tariffs, have gradually ceased to operate as they should do, according to the original ideas. But the economic doctrine of free trade has been preached for so many generations that it has been elevated to the status of a sacred principle instead of being merely a means to an end; and it has taken not only the lessons taught by the war, but also the trade upheaval of the post-war years (culminating in the worst industrial depression within living memory) to shake the faith—if not of doctrinaires—at any rate, of their disciples.

But the faith has been so severely shaken at last, that the country at large is evincing an unprecedented interest in the doctrines of the reformers. Briefly put, these show that the bulk of the leading countries of the world are no longer willing to import what they think they can make for themselves, and are raising tariff walls against which it is hopeless for British export

trade to contend. On the other hand, the surplus goods manufactured in those countries, often under conditions of hours and wages which compare unfavourably with British standards, are being increasingly dumped at bargain prices into the free market of the United Kingdom, to that extent displacing our home labour in the manufacture. As a consequence, industry in this country not only is faced with the gradual loss of foreign markets but cannot even, under its system of free imports, retain its proper share of the home trade. And whatever the benefits at one time of cheap foreign goods, they are now under present day conditions being proved to be largely illusory. Since the war a system of unemployment insurance has grown up by which those out of work receive a money allowance (colloquially called the "dole") that is supposed to be contributed by those in employment. But with over two millions of unemployed, not more than 50 per cent. of the dole is covered by work contributions—the rest is found by the taxpayer. Hence it comes to pass that when we in England buy a cheap article from abroad, we pay not merely the foreigner's price, but we also pay the home workmen for *not* making it, so that the total cost of the article, in price plus taxation, is probably as much as, if not more than, if the article were made over here. Other obvious considerations that point to the path of reform are that so long as our factories are not fully employed, the overhead expenses preclude the manufacturer from turning out articles for export what will compete with world competition overseas. The remedy is to secure the home market for home industry, and manufacture a cheap surplus for export. Finally, a country devoid of tariffs is obviously not in a position to bargain with those that possess them.

These views have been preached in this country since the days of JOSEPH CHAMBERLAIN, but his was a voice crying in the wilderness. It needed the Great War to point out the moral and open the eyes of those not too biassed to adapt their theories to the needs of the day. But even the war did not convert the doctrinaires, and it has needed several years of increasing bad trade to arouse opinion at large. The Conservative party were the first to learn the lesson of the War, and they tentatively and somewhat hesitatingly introduced a policy of limited safeguarding of industries, which is claimed by its advocates to have been an unqualified success. But excess of caution and divided counsels in that party delayed the development of their reform policy, and the country deprived them last year of the reins of Government, putting the Labour party in, in the hopes that it would solve the problem of unemployment. But though the Trade Unionist element in that party—that is, the representatives of the workman—is increasingly imbued with the advantages offered by protection, the control of the party is too much in the hands of the doctrinaires, and these cannot abjure the tenets of free trade. Hence after fourteen months of office, they have come no nearer solving the unemployment problem—indeed they see it worsen day by day, while the doctrine of protection of industry is being preached by their rivals up and down the country. As for the Liberal party, though they commanded some five million votes at the last election, they are without any constructive policy, and they are committed to regarding free trade as an unchangeable principle. The future lies most with the Conservative party who are now converted to a fuller policy of safeguarding home industry, and hope that the next general election will restore them to power; failing that eventuality, the country will have to wait till the Labour party change their views as they assuredly if slowly will.

The above statement of the trend of home affairs is necessary to a proper understanding of the changed outlook of the politicians. In the case of the country at large, the change of opinion in its view of trade economics has been most marked of late months The Chambers of Commerce (even in Lancashire), the Manufacturers' Unions, many leaders in the banking world (generally the slowest to change their economic outlook), and industry in general—all these have expressed the view in no uncertain voice that the time has come for a change in our industrial system. Fortunately or unfortunately, two newspaper magnates running popular papers of vast circulations have somewhat confused the issue by trying to call the tune for the Conservative party, and the two are not even agreed as to the policy to advocate. Lord BEAVERBROOK, who was born a Canadian, has come forward with a scheme of Imperial free trade, which involves the taxation of foreign food but free admission of any coming from the Empire ; his idea is a sort of Empire Zollverein, and he remains impervious to the argument that however desirable it may be in theory, it is not fully achieveable in practice save by years of long negotiation. The Conservatives believe in Empire free trade, and will work for it. But they hold that the first step to take is to preserve industry at home and they are still nervous as to the effects of suggesting "food taxation." The Empire policy must follow by instalments, if only because the Dominions already have tariffs against most imports and these cannot in the nature of things be discarded immediately, even were the will to do so manifest. The difference between Lord BEAVERBROOK and Mr. BALDWIN is largely a matter of the means to achieve a common end and a difference of opinion as to how soon that end can be achieved. Unfortunately, the newspaper owner wishes to set the pace for the party and there is some real danger that lack of co-ordination between them may result in electoral rivalry, such as may lose the next election for them both. But it is to Lord BEAVERBROOK's credit that he has made his policy a live issue in the country, has stirred up public opinion to express its views, and has forced the politicians to say on which side they stood.

Empire Free Trade and Sugar.

It is in the idea of Empire Free Trade that the British sugar industry overseas will be most concerned ; the policy of safeguarding if extended at home will chiefly affect the home beet industry and the refiners. Mr. BALDWIN in the course of a political speech has expressed the view that sugar beet agriculture in the United Kingdom has scope for double its present output, and even if he refused as he did to forecast his attitude to the continuation of the subsidy, it is obvious that he foresaw the need for continued protection and was prepared to advocate it. But for sugar overseas the larger policy of Empire preference is imperative. What then has it to offer the industry ?

Another general election within the next twelve months seems a highly likely event, because the present Government have no clear majority in Parliament and rule by the consent of the sixty Liberals. If the policy of tariff reform makes decisive headway and the electorate put the Conservatives into power again, we may reasonably hope that while they concentrate at the start on home problems, they will immediately inaugurate such Empire free trade policies as there is a precedent for. Sugar fortunately stands in the list as a food that has already been taxed, so any pledge not to tax food in this country without a further mandate cannot very well apply to sugar. The fiscal preference on sugar already exists ; the sugar duty is a long established means of revenue. Hence it is reasonable to suppose that a newly elected Conservative Government would take early steps to remedy matters

in the sugar industry. It is fairly safe to anticipate that the preference would be increased, possibly by admitting Empire sugar free and continuing to tax foreign sugar ; that a real attempt would be made to restore confidence to our Empire production overseas ; and that an increasing amount of the sugar consumed in the United Kingdom would be bought from such production. But the time for this is not yet, though it seems more imminent than it has ever been so far.

When the moment arrives to carry out these reforms, two things, we think, must be postulated. The colonial sugar industry must eliminate the weak points in its *modus operandi.* The report of the West Indian Sugar Commission has indicated some of these. Doubtless they would mostly have been remedied by now, had funds allowed ; but the complacency of the past was persisted in too long and when the tide turned and sugar fell to an unprofitable level of price, the way was lacking even if the will existed. The other point, as we view it, is that there must be real reciprocity. If we are to take on preferential terms the sugar of the Empire overseas, there must be corresponding willingness for the sugar producer to continue buying his sugar machinery and factory equipment and supplies from the country that consumes the sugar. We mention this point because we notice a tendency[1] for the Dominions and even the colonies to draw more on local sources for their equipment needs and less on the engineering shops of the old country. Even Mauritius, as is shown in Sir FRANCIS WATTS' recent report, is developing engineering shops, capable of making much of the machinery required for the factories. Such large items as vacuum pans, triples, crystallizers, juice heaters, elevators, pumps, etc., are being supplied to Mauritius sugar factories from local engineering shops. And this practice unless challenged will tend to increase, to the detriment of the old-established engineering firms in England and Scotland. These last should assuredly not be overlooked if and when the time comes to place the Empire sugar industry on a firm basis ; if the United Kingdom assures the market for the sugar, it should be guaranteed the main share of making the plant and equipment to produce that sugar.

The Queensland Sugar Industry.

The present agreement between the Australian Commonwealth and the Queensland cane sugar producers expires a year hence. This is a measure of protection which those in the northern half of Australia realize to be inevitable, but is a source of perpetual grumbling on the part of the much larger population inhabiting the southern half. As the time for reconsidering the agreement approaches, those in favour of renewal and those against it develop political activity.

According to a *Times* telegram from Melbourne, the opponents are claiming that the embargo on foreign sugar costs the taxpayers five and a half millions a year, and even the highly protectionist paper, *The Age,* protests against this " outrage of legalized banditry and act of definite hostility to the people," and asks only for a protective duty against imported sugar produced by cheap labour. This strong language is some indication of the feeling of the people in the temperate climes of Australia at the price they have to pay for the sugar produced in one corner of their continent.

But it may be said with justice that these Australians cannot have their cake and eat it. Several decades ago, for good or ill, they decided to banish the coloured or Kanaka labour from their canefields, this being part of their deliberate policy of keeping Australia "white." They ignored the fact that practically everywhere else in the tropics and semi-tropics the main labour

1 Doubtless a legacy of the war days, when communications were slow and orders difficult to complete.

of the canefields is coloured, and receives the pay of coloured labour. Queensland was purged of its cheap labour; white labour at trade union rates of pay (always high in Australia) steadily took its place and carried out the job of sugar production— at a price. But the world price of sugar is necessarily lower and has been markedly so the last few years, and but for the State embargo on foreign sugar, Australia would have proved a convenient dumping ground for the world's excess sugar, as a consequence of which the Queensland sugar industry would have found its product unsaleable. Nor would things be better if there was, as suggested, merely a duty against sugar produced by cheap labour, for who nowadays is to decide whether sugar comes in that class or not, when the ruling world's price is lower than one at which most producers employing cheap labour can be said to make a profit at all. It seems clear to most onlookers that so long as Australia wishes to produce her own sugar and do so with white labour, the price must be paid. This price is paid *inter alia* in consummation of a national policy of keeping the northern Queensland littoral populated with whites, as a racial barrier against the oriental peoples living to the north of Australia. It is doubtful whether there is any other industry alternative to sugar that would suit the Queensland climate. Sugar, then, is so bound up with State policy that it is hard to conceive the Commonwealth Government making any radical change in the system at present in force. Unfortunately there have not been wanting indications of late years that Commonwealth policy is apt to clash with the interests of individual States and vice versa. The larger part of the Australian population lives so remote from the Queensland canefields, that it is conceivable that they may through their State Legislatures force the Commonwealth Government to modify the assistance granted to the sugar producers. Time will show how far the opposition has gained force since the last agreement was signed. Those who see a future for Empire Sugar in supplying the needs of the United Kingdom will regret it if, on the possible eve of the venture, the Australian sugar industry is launched on a sea of troubles owing to dissension within its borders.

The Freight Market.

Following the large sales that were recently made of Cuban raw sugar to Russia at extremely low prices, a novel feature in the freight markets has been the chartering of boats for the transport of this sugar to Leningrad and the Black Sea at very low rates of freight. Shippers have taken full advantage of the generally depressed state of the world's chartering markets to secure tonnage at cut rates, although it is satisfactory to note that the prospect of obtaining a fairly remunerative cargo homeward from the Black Sea and the Danube is now greatly enhanced owing to the fact that, in order to facilitate business, the Rumanian Government's recent action of reducing the export tax on grain and entirely abolishing it on barley has led to greatly increased activity in that part of the world. A number of steamers were chartered to load sugar from Cuba to Leningrad at 15s. for July and August loading, with later transactions, including a good-sized vessel at the better rate of 15s. 3d. for July shipment. Tonnage was also arranged from Cuba to the Black Sea at 16s. for July. An interesting fixture was that of 5000 tons of sugar by a Norwegian steamer from Greenock to the Black Sea at 11s., option Greenock and Liverpool loading at 11s. 6d. for immediate shipment, this vessel being simultaneously fixed homeward with grain from the Black Sea at the rate of 10s. 9d. per ton. There are renewed enquiries in the market for tonnage to load sugar from Cuba, and further business is expected shortly to mature on the basis of recent transactions.

Conditions in Cuba at the End of the 1930 Crop.

By EARL L. SYMES.

The grinding season in Cuba which began on January 15th, 1930, terminated the end of June with a total production of 4,671,230 long tons Spanish weight, showing an average monthly production of about 850,000 tons over the five and a half month period. The decrease from the crop of 5,156,410 tons made in 1929 was 485,180 tons or 9·4 per cent, as compared to the 10 per cent. reduction mentioned in our report of last August. Central Vertientes made more sugar than any other mill this season, producing 830,320 bags in 135 days, about 122,000 tons.

Early spring rains in April tended to lengthen the season, but of course were very beneficial to the ratoons and fall plantings. The total rainfall in the first five months of 1930 was 15·94 inches, as compared to only 8·47 in 1929, and to a normal precipitation of 14·95 inches for this period. Nearly every section of the Island has received its share and the North Coast of Oriente, one of the driest regions last year when only 5·20 inches fell in the five months, has received 20·29 inches this year.

Indications are that this excellent growing weather will continue and for that reason no natural reduction of the coming crop may be expected due to weather. Considering the ruinous level of prices and the large stocks on hand there is little incentive to think of the 1931 crop, and no forecasts have been made. It is reported that fifteen or twenty mills may be idle unless conditions improve, but in many cases there is the possibility that their cane would be milled somewhere else. Unless restriction is again resorted to, there is little likelihood that the coming crop will fall more than 10 per cent. below the one just completed.

The imposition of the new U.S. two cent duty on Cuban raws on June 18th did not help the situation ; the increase of 0·2352 cents per lb. was immediately reflected in a corresponding reduction in the Cuban raw price, so that Cuban producers are paying the increase and not the U.S. consumer. This latter personage has reduced his consumption about 5 per cent. in the first six months of 1930 in spite of the low price and the widely-heralded advertising campaign of the Sugar Institute which it was hoped would increase consumption in the United States.

This falling-off in consumption in Cuba's largest market may reduce the estimated tonnage to be taken by the end of the year to about 2,500,000 tons. Another factor tending to reduce imports of Cubas is the provision in the new Tariff which allows the refund of 99 per cent. of the duties paid on sugar exported within a certain period without regard to strict identity, Peruvians may replace Cubas in the California and Hawaiian fruit export trade. The position at the end of the year may be estimated as follows :—

	Long Tons Spanish Weight.
Stock in Cuba old crop sugar, January 1st, 1930	340,000
New crop production	4,671,230
Total available for 1930	5,011,230
Estimated Cuban consumption	161,230
Net for export	4,850,000
Possible shipments to U.S.A.	2,500,000
Balance for other markets	2,350,000
Exports to such markets last year	1,100,000
Remainder	1,250,000
Present prospective shipments to Russia	400,000
Probable carryover in Cuba at end of 1930	850,000

It is reported that 235,000 tons of the sugar for Soviet Russia have been confirmed. About one million tons have already been shipped to the U.S.

but there is no incentive to accumulate stocks there this year, so that the bulk of the carry-over will be in Cuba, which with, say, 200,000 tons stock in U.S. will total somewhat less than the final stock of 1,100,000 tons on hand at the close of 1929 in both countries. Five hundred thousand tons of the shipment to other markets had been made at the end of June, so that a balance on hand of 3,350,000 tons in Cuba, about one million tons more than last year, was depressing the market with its uncontrolled weight.

Efforts to organize the Cuban producers have been started again by one of the groups which was most active in fighting the Co-operative Export Agency. The Santa Clara Mill owners have obtained the support of the National Mill Owners' Association which has issued a circular to all members urging them to join this new voluntary organization, which as a beginning has asked for an allotment of 10 per cent. of its production by each mill to form a pool to sell to Russia or other new markets. In the four-week period since its inception only 37 mills producing 800,000 tons have offered sugars, totalling 60,000 tons or about 7·5 per cent. to this pool. The larger producing groups have not joined and it is probable that they will remain outside for the reasons outlined in our June article. This organization is making a commendable effort to increase consumption and it is lamentable that it could not have been injected into the old C.E.A. which had 100 per cent. membership. Such an organization with active and energetic co-operation from within, undertaking a campaign for world-wide expansion of consumption, could have obtained worth-while collaboration on an International scale from other important sugar exporting countries. It is reported that a committee of this new organization now in New York has begun discussions with U.S. and other producers regarding restriction of plantings for a few years, with tentative cuts of 20 per cent. for Cuba and 10 per cent. for Java proposed. It is difficult to believe that any actual results can be obtained in this way, in view of past experiences and the present trend of opinion in Europe and Java, as reported by Sr. Viriato Gutierrez, who was at the head of the C.E.A., and has just returned from Europe.

It is now three months since the C.E.A. was overthrown, and as it operated for three months on the 1930 Cuban crop, a comparison of conditions before and after may be recorded for future reference. The total sales by the C.E.A. to the middle of April were as follows :—

Crop.	Long Tons.	Price Cents per lb.
1928-1929	421,650	1·88
1929-1930	696,667	1·585
Total ..	1,118,317	1·696

In the past three months of uncontrolled selling about 700,000 tons has been sold and shipped at an average f.o.b. price of about $1·35, some 23 points lower than the price obtained by the C.E.A. This decrease in price on the 700,000 tons amounts to about $3.600,000, or the cost of free sales and liberty in action to the producers during the first three months of unco-ordinated selling. Complaints that the C.E.A. was not selling rapidly enough were groundless since no greater movement has been noticeable under free selling methods. The expected improvement in price, etc., predicted by the opposition has not been realized, and the recent desire on the part of some of the principal agitators to form a new, but voluntary, organization indicates that a real need exists for some control of sales.

The Mauritius Sugar Industry.[1]

The Methods of Cultivation in Use.

Topographical.—In Mauritius the cultivation of sugar cane is carried on from sea level up to elevations around 1500 ft., consequently the temperature and rainfall vary considerably, the former fluctuating between 67·3°F. (mean) in the highlands and 77·1 at Port Louis, while the rainfall is as high as 126 in. in the highlands and about 38 in. at Port Louis. The temperatures cited are very considerably below those of Java, where the mean temperature is around 80°F., and also below those of the West Indian islands. Cyclones periodically visit the island and prove very destructive to the cane crop, the annual loss from this cause being estimated at 4 per cent. ; the actual loss on occasions is terrific.

The soil is lateritic, derived from the disintegration of the basaltic rock fundamental to the island ; this lateritic soil is underlain in most parts by an infertile subsoil which appears to possess toxic properties, hence deep tillage is inhibited and care has to be taken to avoid turning up the subsoil and mixing it with the fertile top layer. Any attempt to practise deep ploughing meets with disastrous results.

The soil is, however, very permeable by water, so that there is no necessity to dig surface drains. The land is kept in very good tilth by hand cultivation with the hoe, or by shallow ploughs or cultivators, and is usually kept very free from weeds. But in many parts of Mauritius the surface is covered with boulders of varying sizes, the largest measuring several feet across. Where these are numerous much labour is expended in clearing the land to be cultivated. This work forms a regular item of expenditure under the title of *epierrage*, and may cost from 10s. to as much as £20 per acre and even more. In some instances the stones are piled in large heaps several feet across ; in others they are placed in long rows or walls a given distance apart, the canes being planted in the spaces cleared. In some instances the walls are pulled down each time the fields are re-planted, and are re-erected on what was the cane row ; the new canes are then planted on the ground lately occupied by the stone rows.

Planting.—There are two planting seasons in force, a short one from September to November for canes to be reaped when about 12 to 14 months old, and the other from April to November for canes to be reaped in about 18 to 24 months. The reaping season extends from about August to December. The canes are usually planted in shallow oblong holes prepared by means of the hoe, but in some instances a shallow furrow is opened with a light plough. It is common practice to place a substantial layer of a carefully prepared mixture of filter-press cake and ashes at the bottom of each hole and to place the cane cuttings thereon ; the cuttings are then lightly covered with earth and a layer of well-prepared farm manure is placed over all, the usual quantities per acre being about three tons of the press-cake mixture and from three to five tons of the farm manure. It is customary to apply chemical fertilizers about two to three months after planting, various mixtures being used, or either nitrate of soda or sulphate of ammonia. In addition, chemical fertilizers are used extensively both for plant and ratoon canes.

Practically all the molasses produced in the factories is used as fertilizer for canes ; it is diluted with about 30 per cent. of water and poured into the cane holes, either before planting or shortly afterwards, to the amount of

1 Culled from the "Report on the Mauritius Sugar Industry," prepared by Sir FRANCIS WATTS, K.C.M.G., for the Secretary of State for the Colonies and recently presented to Parliament. What follows applies to the practice of regularly organized estates, and not to the standard of the small cultivator.

3 to 4 tons per acre. In some cases molasses is mixed with fine bagasse and then sent to the fields, while in others it is poured on the manure heaps together with water and allowed to take part in the fermentation of cane tops, scum-cake, farm-yard manure, etc. Such mixtures are used in planting to the extent of from 3 to 8 tons per acre. Generally speaking, there is insufficient molasses to dress both plant and ratoons. It is claimed that considerable increase in yields is obtained from the use of molasses as a fertilizer, and the claims seem to be well founded ; probably the successful use is connected with the peculiar nature of the soil and its complete aeration.

Cultivation.—Mechanical tractors, often of the Cletrac or similiar type, are used to haul the light ploughs and cultivators employed, and one is surprised at the effective manner in which these are handled on land which at first sight appears to be intractably stony. Their introduction was, however, induced by the fact of *surra* disease having in past years almost exterminated working farm animals, such as mules and oxen. For the same reason the estates have been extensively fitted with systems of mechanical transport. In 1928 there were some 1500 kilometres of railway track and 222 locomotives in use on the estates of Mauritius. Portable tracks are also extensively used.

After the plant canes have been cut, the land around the stools is cultivated, the trash being arranged between the stools or lightly buried in furrows, thus assisting to maintain the supply of organic matter in the soil. Subsequently chemical fertilizers are applied. There is then no lack of attention to manuring the canes; in some respects indeed there is a possibility that excessive quantities, especially of nitrogenous fertilizers, are employed, and the Department of Agriculture is investigating the matter. It is however possible that in seasons of heavy rain a good deal of the nitrogenous plant food is leached away, so that the actual quantities applied may not be excessive for the plants.

Cane yields.—Given favourable seasons the yield of canes per acre is high, under very good conditions reaching 50 to 60 tons in the case of plant cane, and 30 to 40 tons as ratoons. The average yield on good estates may be taken as about 30 tons for plant cane and 22 tons for ratoons, while 18 to 20 tons per acre from fifth and sixth ratoon canes is not unusual, this last being ample evidence of good work done and of the fertility of the very shallow soils on which the canes are grown. The production of ratoons is relatively inexpensive as compared with plant canes, the principal item of cost being that of light tillage and weeding and the provision of fertilizers, which last account for 25 per cent. of the outlay. Plant canes cost about three times as much as ratoons to grow. As many as eight ratoon crops are taken from the same stools.

Sources of Manure.—The agricultural practices in vogue in Mauritius result in returning to the soil large quantities of organic matter existing in factory waste products, furnace ash, molasses with its potash and nitrogen content, leaves and tops, etc. Great attention is paid to the preparation of the *fumier* or farm-yard manure.

The system consists in making great heaps of cane tops, leaves or trash with grass, bush and other vegetable matter (sometimes cut up in a chaff-cutter) in considerable excess of the food requirements of the cattle, and allowing this to become impregnated with the excreta of the animals, which are kept upon the heaps for a short time. The impregnated mass is removed and kept in great fermenting heaps, maintained thoroughly moist by the application of the drainings from the heaps, or of water. All this is often done under cover, but at times in the open ; better control is effected under cover.

This system, known as the Mauritius system, results in the production of quantities of farm-yard manure far in excess of that derived simply from producing the manure from stable litter, and is now extensively employed in other countries : its adoption, which permits of the conversion of large quantities of litter, bush and vegetable matter into valuable and well-rotted farm-yard manure is to be commended, for it is sound in principle and helps to off-set in no small degree the shortage of manure resulting from the increase of mechanical forms of transport and the decrease of the number of farm animals.

Cane varieties.—Several varieties of canes are cultivated, the principal being the White Tanna, which in 1925 occupied 58 per cent. of the cane area. Some estates that year had over 90 per cent. of their canes in Tanna varieties, these having increased considerably in favour in recent years. Other varieties (all under 10 per cent.) include DK74, D109, D130, Uba (1 per cent.), M 55, 131 and 33. A number of imported varieties of promising canes are under test in the quarantine houses of the Department of Agriculture.

Insect pests.—The chief insect pest in Mauritius is the beetle *Phytalus Smithi*, which occurs extensively, is quite difficult to control, and is doing much damage in certain districts. First discovered in 1911, it is now estimated that intense infection occurs on about 2500 acres, chiefly in the Pamplemousses and Rivière du Rempart districts. The endeavours to control this pest are supervised by the Department of Agriculture, which has a special staff at work. Various methods are adopted to cope with it. Systematic collection of the beetles by hand at night is undertaken regularly, and by this means in 1928-29 no less than 252 million beetles were taken and destroyed. In addition nearly a hundred million of the larvae were collected from the soil round cane roots. The official expenditure in the year in question was £8328, of which £6080 was for beetles collected. Other methods of control adopted include the use of carbon bisulphide, Paris green, vaporite, kerosine, carbonic acid and others ; these have proved of but limited use. A more successful line of attack is the introduction of parasites. The wasp, *Tiphia parallela*, obtained from Barbados, has been established with good results, and more recently another wasp, *Elis thoracia*, has been tried.

Irrigation.—In Mauritius the work of irrigation may still be regarded as in the experimental stage. For many years past those cane estates adjacent to rivers have drawn on the river water for irrigating their fields, the water under definite regulations being led into small reservoirs on the estates and then distributed ; but the practice has not been well controlled and wastage of water has occurred. Since 1911 two big irrigation schemes have been developed. One at La Ferme with a storage capacity of 2594 million gallons and furnished with 21 miles of distributing channels supplies water to some 3000 acres in the Black River district in the western part of the island. Another at La Nicolière in the northern part of the island is estimated to be capable of irrigating about 7500 acres, its capacity being 1263 million gallons. But the financial success of the schemes has been affected at the outset by the fact that the fields have not been laid out and planted with a view to irrigation and the users of the water have not had much experience of irrigation work. To remedy these defects, an officer of the Dept. of Agriculture paid a visit to Hawaii and studied the irrigation systems in successful use there. Since his return he has been demonstrating for the guidance of planters the methods which appear to be suitable for the districts in question. Thereby it is hoped that a far more economical use of the available water will result.

Alcohol Production for Motors in Brazil.

By Dr. FREDERICO W. FREISE.

In a country like Brazil the fuel problem belongs to the most vital order of things ; the independence of a rapidly increasing national industry is very intimately linked to this problem. During the last few years an important element of work has been done to develop a national fuel industry from inferior cane varieties, molasses, and discarded sugar. No State of Brazil is more interested in such fuel than Pernambuco, and now it seems that the problem is nearing solution.

Some months ago the State Congress voted a bill which grants far-reaching benefits to the producer of a really good motor spirit ; and now one plant with a daily output of about 100 tons of such alcohol is being put to uninterrupted run. The Central Railway of Brazil, the property of the Federal Government, has taken up a protracted series of experiments to utilize motor spirit on the motor rail cars recently introduced for suburban and branch line traffic. Two months ago the first trial was given to a national motor spirit " Azulina "—alcohol with 5 per cent. of ether, denaturated by 0·1 per cent. of methylen blue—on a broad gauge motor car over 71 kms. of line. After this trial had given full satisfaction, an experiment on a wider basis was made during May on the Rio S. Paulo main line—500 kms. with heavy mountain grades. The fuel was used on a motor car fitted with two T.A.G. motors of 100 H.P. each which at 1200 r.p.m. give the car a speed of 84 kms. (52 miles) per hour on a level track. The car has front and rear control and can develop four speeds ahead or two speeds in reverse transmission. Ignition is by magneto and battery ; the motors have four cylinders, each having two sparking plugs ; each motor is cooled by two independent systems ; the motor governor is of the electric type ; the fuel tanks are located on top of the car. Each motor has two dynamos for the batteries—12 volts—and the automatic starter. When two cars are coupled together, a train of six cars—320-385 passengers—can be run.

The distance between Rio and S. Paulo—500 kms.—was covered in 11 hrs. 44 min., 4 hrs. 5 min. being stops. The home trip was made in even better time, being covered in 9 hrs. 51 mins. The heaviest mountain grade of 28 kms. with a rise of 416 m. was negotiated in 3rd gear. The average fuel consumption was 1·40 litres of " Azulina " per km., parallel tests having shown the gasoline consumption as being 1·00 litre per km. Actually the price for " Azulina " is 500 Milreis per 1000 litres, whereas gasoline is bought at 1000 Milreis for the same quantity. The official experiment has therefore shown complete success.

As there are about a million tons of inferior cane available in the principal sugar districts, the quantities of discarded sugar and molasses being beyond any calculation, it seems that all conditions covering the raw material are fulfilled ; capital seems to be eager to invest in this new industry, at least in Pernambuco and S. Paulo, Pernambuco being the prospective distributor for the northern States and S. Paulo for the central and southern ones. There are now about 92,000 motor cars in Brazil ; national enthusiasm hopes to equip at least 50 per cent. of these with alcohol-burning outfit within a very short period.

SUGAR HEADS THE AMERICAN TARIFF.—According to Lamborn, the largest single item of the American tariff collected during 1929 came from Cuban sugar, which paid during that year approximately $197,000,000. This amount is slightly less than one quarter of the entire amount collected by the U.S. Government from import duties.

The German Association for Sugar Exportation.

By Dr. H. C. PRINSEN GEERLIGS, Ph.D.

During the years immediately after the conclusion of peace, the German sugar industry was unable to supply even the greatly reduced quantities of sugar needed for consumption, so that a not inconsiderable quantity had to be imported to keep the nation provided with as much sugar as was allotted to it. Gradually, however, the sugar production increased and although the German population was supplied with increasing amounts of sugar and regained in the end full freedom of consumption in that article, the quantity turned out in 1926 was already larger than the consumption.

Owing to various circumstances, on which it is needless to dwell here, the cost of production of German sugar was greater than the world's parity ; but a rather high import duty which was repeatedly increased, permitted the producers to obtain a good price for the sugar consumed in the country. On the other hand, the surplus of production over consumption, swelled by some sugar imported from Czecho-Slovakia, Danzig, Java, Guatemala, etc., had to be sold on the world s market and, as a consequence of the high production costs, had to bear a loss.

It is evident that in such circumstances the individual producers are loth to export, and try to turn over as much of their crop as they can to the profitable home market, thereby competitively reducing prices and giving rise to all kinds of trouble.

With the two-fold intention of keeping foreign sugar out of the country as much as possible and further of dividing the share to be exported at a loss as evenly and judiciously as possible among the different producers, a Sugar Exportation Association was established in 1926 as one of the subsidiaries of the great Association for the German Sugar Industry. The Board of that branch calculates every year the amount of sugar consumed in Germany, ascertains how much the production and stocks are in excess of that quantity, and contingents this balance among the different producers *pro rata* of their production.

Unlike a scheme of similar purpose in Poland which has been rendered obligatory by the Government, the German Association consists of the proprietors of sugar factories who join that body of their own free will ; and it is a happy feature that very soon after its creation all the parties concerned had signed the agreement, so that it has become just as effective as though it had been enforced by Governmental degree.

In the year 1925-26 Germany exported 129,425 tons or 8 per cent, of her production ; in 1926-27, 207,376 tons or 12·5 per cent. ; in 1927-28, 155,392 tons or 10 per cent. ; in 1928-29, 220,031 tons or 13 per cent., while in 1929-30 an exportable quantity of 295,000 tons or 15 per cent. is foreseen which, however, is still open to amendment, in case the sugar consumption during the last three months undergoes considerable alteration.

From the very beginning the scheme worked smoothly ; all producers entered into the combine, fulfilled their obligations and promptly exported the contingent assigned to them without a hitch, to the foreign market paying the low prices.

Only in 1928 did a few instances occur in which some producers failed to export their contingent for some reason or other.[1] In accordance with the by-laws of the association they were fined and the amount of the penalties distributed among the members who had exported their due. However, some

[1] Some of them had failed, and another had had a fire in which part of his sugar was burnt.

debatable points sprang up and therefore last month it was resolved to make a few changes to render the scheme more stringent still.

Notwithstanding the high duties on importation, some sugar has managed to come in, e.g., from Danzig (owing to certain articles in the Versailles treaty); from Czecho-Slovakia to cities in the South of Germany; and raw cane sugar imported by that minority of consumers who ascribe a higher amount of nutritive and dietic principles to that article than to refined sugar. But the latest rise in the duty, to 32 r.m. per 100 kilos., had practically done away with these imports save that from Danzig, so that only stocks and production have now to be considered.

The penalty incurred by producers, who for some reason, are unable to export, will no longer be distributed among the other members, as this method does not meet the purpose of relieving the home market, but will be used to purchase sugar in that market and export it. Further, the penalty will be increased so as to make it more efficient. The sugar calculated to exist in dried beets, in STEFFENS' sugar pulp, and in fodder mixtures containing syrups of over 70 degrees purity[1] will be taken into account when considering the basic quantity for the calculation of the contingent to be exported. The sugar contained in exported sugared articles (amounting in 1928-29 to 827 tons) is also to be considered as incorporated in the exportation contingent.

By June 18th the last sugar factory had signed the agreement, which will, therefore, become effective from September 1st, 1920, and is to last till August 31st, 1931, if not prolonged after that date.

The general feeling is that the new scheme will be as great a success as were its predecessors in the then prevailing circumstances; and it will help to supply the German nation with its full provision of home grown sugar[2] at a reasonable price, giving the producer a profit and enabling him to export the surplus, obtained in years of good crops, on to the world's market in a proportion equitable for his other colleagues.

Krupp Grusonwerk.

One of the oldest German engineering works, that of HERMANN GRUSON, who founded the firm at Magdeburg bearing his name, has recently celebrated its 75th anniversary, having started in 1855. GRUSON concentrated on cast iron and succeeded in turning out what, for his time, were qualities of markedly high tensile strength and of extreme hardness when chill cast. Meanwhile the rival firm of Krupp was experimenting with steel, and the two competed in the game of turning out armour-piercing shells and shell-resisting armour; first one gained the upper hand for his metal only later to succumb to improvements effected by the other. In the end, the two rival firms came to realize the futilities of competition; when ALFRED KRUPP, the founder of his firm, had died in his seventy-fifth year, the way was opened for amalgamation of the two interests and in 1892 they formed the new firm of Krupp Grusonwerk, under the control of Krupps. The production of war material was then increasingly transferred to Essen, while the Magdeburg establishment sought its development in the field of more peaceful industrial activities, only interrupted by the war period. Amongst the products of this Krupp-Gruson combine machines and plant for the treatment of tropical products find a definite place, and large, medium and small sugar milling plants are turned out as well as complete sugar factories; while cane derricks, cane wagon tipping apparatus, cane conveyors, and baling presses are also produced. Any interested in the history of this firm should apply for a copy of a large brochure of some 68 pages which forms as it were a 75th Anniversary number.

1 In 1928-29 412 tons for the latter item alone.
2 Except for the importation of Danzig sugar under the Versailles Treaty.

Sugar Cane Culture in Porto Rico.[1]

Outstanding Features in 1929.

By E. D COLÓN.

Sugar cane culture in Porto Rico to-day is a one-crop system indefinitely succeeding itself on the same lands, except for short periods of time. Attempts at legume rotation are few and half-hearted. Grass fallows persist only in so far as required for work animals. Indications are suggestive of an unconscious segregation of cane from animal husbandry, of high-priced cane from lower-priced pasture lands. Furthermore, the next few years apparently promise to witness a determined attempt to motorize all field activities as far as practicable. We have particularly in mind the hauling out of cane from the fields. The principles of the scientific rotation systems have proved too slow and unadaptable, and counter to the all-powerful, world-wide movement towards specialization. It is well to remember in this connexion that a rotation of crops will not maintain the fertility of any soil without outside aid. Crop rotations did not originate from their efficacy as a soil restoring scheme, but as a result of social and political expediency. A grass sod is very apt to conserve the nitrogen supply of a fertile tropical soil better than a cultivated leguminous crop. Nodule bacteria prefer to use the nitrogen in the soil when in plenty. They require, besides, mineral fertilizers for their optimum results. Industrial chemists are drawing nitrogen out of the air faster than legume-bacteria will ever do it. Reference may be made here to the works of LATSHAW and SWANSON in Nebraska, PIETERS in the *Journal of the American Society of Agronomy*, GREAVES in Utah, HOPKINS of Illinois and Dr. RUSSELL of Rothamsted. Finally, the naked fact is that the sugar cane grower, of his own volition or not, is now on the highway of intensive specialized agriculture.

Successful travel on this road opens up new horizons to agriculture and to civilization. Dr. MAXWELL was prophetic when he stated in the beginnings of his epoch-making work in the Hawaiian Islands, that his figures led him to believe that there was room on an acre of cane for a fifteen-ton crop of sugar, if all the elements of production were known and properly handled. It is common knowledge that his record has been surpassed by his successors. Uniform, long-lived progress on this road postulates a relentless advance towards the mastery of the elements of production and an ever-increasing sensitiveness to the social responsibility involved. Somewhere in a corner, behind the firing line, a group of men must always be maintained in constant scientific prevision of possible surprises on the way onward.

Mastery of the elements of production requires means : means to find out, means to act, means to share. Rent is high. Taxes are high. Money is high. Machinery is costly. Landscape-transforming improvements like drainage and irrigation works, hygienic homes and surroundings, and inspiring community interests are so many more occasions for disbursements. Concerns without annual accretions for a surplus under normal weather and market conditions are organically unhealthy and very liable not to be able to withstand the stress of the ever-recurring bad years or the severity of the economical dictum that land will eventually and inevitably move into the hands of the parties that are in a position to get the most out of it. The attainment of such a position should be planned for. It has not seemed so awfully hard in the past when one considers that the proceeds from the sale of the final molasses of any group of centrals near enough to each other for the purpose, would, at the prices obtaining, pay inside of twenty years for the most exacting field equipment and drainage and irrigation installations. It seems harder

1 A Paper read before the Association of Sugar Technologists of Porto Rico, at San Juan, December, 1929.

now after the damage wrought by the cyclone of San Felipe. The government might find it good policy to consistently divert its future investments as much as possible to such permanent improvements as are lacking now in large promising sections of the Island, that could only be carried out successfully by impossible mergers of present independent companies. Too many of our water-courses reach the sea unscathed. Too many of our lowlands are still unproductive malarial bogs that sap the vitality of the neighbourhoods. When the Dutch decided that Holland was too small for them, they went for land to the bottom of their seas.

And here, on Porto Rico, land is all important to the sugar industry and to the public. At the present stage of the colono system, the need of plenty of good cane near the factory for its smooth and economical operations will compel its directors to maintain good control of a good proportion of the crop and of the land to grow it on. Ownership of the land insures them, besides, full value for their factory at all times. Given a certain mill capacity each additional facility for irrigation would tend to reduce the acreage necessary for a crop, thus releasing marginal lands for other purposes. On the contrary, practical men in unirrigated sections will always pin their faith on a large acreage rather than on fine points of intensive, dry-farming practice, thus withholding the poorer lands from other uses without great benefit to themselves. And yet one cannot but feel that they are right. Their hard experience has taught them that no amount of ordinary tampering with the stools of cane ever insured them a good crop in dry years. The only way to increase the quantity of "real" water at the disposal of the cane crop, aside from irrigation, is to let the rain fall on an additional number of acres. No ; I take it back. There is another way yet : that is, an increase of the time during which rain may fall on the growing cane ; in other words, by the adoption of a larger proportion of long crops like the "gran cultura." The Southern planters are taking advantage of this last method, the "gran cultura" crop attaining at places to as high as 40 per cent. of the total. It is evident, however, that an advantageous position such as the one described is not the case where the land available for the carry-over of the "gran cultura" be, say, only 10-12 per cent. of the annual acreage for harvest due to the pressing need for cane, year in and year out. In conclusion, as things look to-day, a factory without the necessary subservient land is cramped. A plantation without elbow-room must of necessity be sluggish in its turn over. As all classes of land have been selling generally for more than their income-producing power would justify, only a forced march for intensification could break such a vicious circle.

Any such an attempt would be a misnomer without a plentiful water-supply. There are no dissenting voices on this proposition. From the South with its private and public irrigation systems ; from the Isabela district with its most unfortunate irrigation problems ; and from the North and East coastal regions with their partial irrigation schemes there arises a cry for water where they lack it, for more water where it runs short, for crops to water where there are none. Although there is room here for a stricter conservation of the supply, this cry knows its business. Roughly speaking, sugar cane is over 70 per cent. water. A fifty-ton crop requires at least a 100-ton production of organic matter, and lifts from the ground with itself some 70 tons of water per acre at the time of harvest. Eighty, ninety, one-hundred inches of water and more are necessary, according to circumstances, during the season of growth to obtain such and higher yields. Our own figures, based on actual records for a long period of years, tend to show that approximately an average

of 7-8 cwts. of cane may be expected per acre-inch of water received by the crop during its growth in the fertile lowlands concerned. Less-favoured soils would naturally produce less. Approximately analogous figures seem to hold good for a large property of the South for at least one year. However, this correlation is not a new one. RAWSON in Barbados showed that it was possible to foretell the return of sugar per acre within an error of 6·6 per cent., if the rainfall for the preceding twelve months were known. Comparisons often heard of average productions of irrigated versus unirrigated plantations are senseless for lack of a common ground. So are also, for the same reason, all comparisons of average yields between properties developed upon a basis of plant cane as contrasted to ratoon cane.

The water received by the land in excess of the optimum saturation point for the particular soil must drain out, else the cane will suffer. This means that drainage must be attended to. Since the Portuguese river of Ponce disappeared the first time below ground only to re-appear beyond the bridge before flowing into the Caribbean, there has never been any question as to the fact that drainage of the main body of the fertile lands of the South Coast is principally subterranean. So much so, that it might not seem rash to state, *a priori*, that a goodly part of the water applied for irrigation on the higher lands is lifted by pumps on the lower sites and used again once more.

This is not the case with the low silt loams and even the loams of the rainy sections elsewhere. Careful provisions for surface drainage have always been included in all planting schemes, water-furrows and ditches across the rows being considered necessary even in the most favourable situations, and the grand bank system in the least favourable. The soils, on the average, are so fine-grained and adhesive that both capillary and gravitational movements of moisture are greatly retarded. Personally, we have had the opportunity, during a protracted drought, of keeping up the growth of a five-acre experimental field of cane by improvisedly irrigating it with a centrifugal pump, using water of the sub-soil that had accumulated in a collector ditch cut across the same field for drainage purposes. The water could be heard gurgling downs the cracks on its way back to the same collector and to the perimetral ditches. COLERIDGE's image came to our mind then :—

"Water, water everywhere
"And not a drop to drink."

There follow now the weather records for a typical zone :—

Average annual rainfall, inches	58·70	Average monthly rainfall, inches	4·9
Maximum	73·72	Maximum	16·67
Minimum	45·04	Minimum	0·13

In 1922 the maximum rainfall in 24 hours was 3·62 in., Dec. 1, and 5·74 Dec. 1 and 2, 48 hours. There are roughly 175 rainy days in the year as compared with 75-100 in the South Coast. The Spring months, April, May and June, are the driest. River floods occur, as a rule in May and November. A wholesale drainage project carried out in the Arecibo district was doomed to failure from the start for various apparent reasons. Two small scale (15-20 acres) under drainage experiments, with home-made tiles, may be considered successful in various ways besides cane yield, in spite of the fact that the low level of the land called really for pumping—which it did not get—for the voiding of the tile system during very high tides. One small-scale experiment (43-50 acres) for drainage of a field by pumping increased the cane yield approximately three-fold. Highly successful work of this nature

has been done at Central Mercedita, Ponce, and at Central Canovanas at Loiza. Pasto Viejo was improving its project when last seen by the writer. Information was received from Central Eureka some time ago to the effect that equipment had been imported for the making of clay tile, but without news in regard to its workings. Under the auspices of the Rockfeller Foundation, tile-drained demonstration plots are spreading over the Island.

When all the advantages discussed above are not to be enjoyed, when land or water are not mastered, *time* should be made full use of. If rainy days and dry spells cut off a good proportion of effective planting, cultivating and growing days, then there is but one thing to do, which is to carry on the work during favourable weather. This is equivalent to crowding the task into a short space of time. An early " gran cultura " will run for more months, thus having at its disposal more rainy days and more heat units. January and February spring-plant will run a better chance of a good stand before real dry weather sets in. Late Spring plant and June and July ratoons might be left over for harvest in their second year. Reference has already been made to the fact that any such plan would require extra land prepared beforehand and ready for the top seed obtained at the beginning of the grinding season, or from the seed fields for the summer plantings.

Here a new factor looms higher and higher in proportion as the plantation movement is thus accelerated. That is, ample equipment. Four complete sets of steam tackles, several tractors, a thousand oxen, besides horses and mules, seem to keep busy in the annual turn-over of a 3000-4000 acre crop on the South Coast, $\frac{1}{3}$ ratoon and $\frac{2}{3}$ plant cane. Apparently they have at their disposal about $\frac{1}{2}$ horse-power per acre of crop. The cost of such equipment would probably run up the $200,000 figure. It is doubtful if the North and West sections average $\frac{1}{6}$-$\frac{1}{8}$ horse-power per acre.

Parsimony of mechanical power protracts the work beyond fair weather. Wet, slippery, cloddy soils cannot be safely gone over with machinery. The plantings must be made. Hand labour is resorted to ; and the classical holes on the grand bank save the situation, but with a higher outlay. This reminds us of the Javanese planter with his harvested, soggy rice fields before him. He cannot afford to wait until the soil drips dry, and he sends his spade gangs to do the trenching. The spread of the straight-furrow system of planting is responsible for the saving of some time. It is being gradually adopted where well-drained loams or sandy loams are to be planted. It is dangerous to use it on low, silt and clay loams. The writer developed a system intermediate between the classical " chorro " and the " grand bank " by back-furrowing the two-row banks with intermediate water-furrows alongside of them, then throwing any clods and loose dirt on the centre line by means of a specially devised road grader, and making the planting furrows on the banks thus formed. Depending on the kind of soil, cross-ditches are then cut by hand or with the middle-bursters at required intervals. When properly done, the water-furrows should be deeper than the planting furrows so that good drainage obtains. In case of very wet weather, the water furrows can be deepened by hand where water stagnates. Holes are in this way dispensed with, saving expense and labourers when they are scarce. We understand this system has been tried by others, with what success we do not know.

The fact that the irrigated plantation has to keep the furrows clear for water flow and the unirrigated section its ditches open for drainage has reduced intertillage to a minimum. At any rate, this point of superficial cultivation, except for weeding purposes, stands a mooted question, since the results of the

fundamental 125 experiments carried on by Messrs. CATES and COX of the Federal Department of Agriculture were made known to the scientific world. The windrowing of the trash on alternate banks has also limited the question to one-half of the field. In the case of two-row-bank planting, this half is all water-furrows.

One thing, however, seems clear in the writer's mind: that the possibility of our ratoon crops has not until recently been realized. Subsoiling of ratoons is gaining in favour. Tonnages of 30, 40 and 50 per acre are commoner now from first and second year ratoons. It would seem as if knifing the roots before the new shoots come up is capable of bringing about results of incalculable value.

(To be continued.)

The Sugar Trade in Japan.

By WALTER BUCHLER.

The wholesale price of refined sugar in Tokyo is about Yen 20. per 100 kin (132·277 lbs.) and is sold to the public at Yen 0·23 per 1·322 lbs. This high cost of sugar in Japan is the direct result of the tariff protection and sugar consumption tax, which were imposed by the Japanese Government with the avowed object of assisting the Japanese sugar industry. The yield to the Exchequer from the sugar excise was estimated for the year 1929-30 to amount to Yen 82,797,184. In the meantime, Formosa's sugar production is steadily increasing and is estimated to reach the 14 million (piculs) mark for this year as against 12 millions for 1928. This increase in supply has led the Japanese Sugar Refiners' Association to put a limitation on the quantity to be sold during this year in Japan, fixing it at 13,178,000 piculs (1 picul = 132·277 lbs.). Of course, their object is to maintain prices in the domestic market and so far they have been fairly successful, thanks to the protection they receive and can rely on getting at all times from the Government.

But there is bound to come a time—and the sooner it does, the better will it be for the Japanese public—when a halt will have to be called on this subsidization of a few people who control the sugar business in Japan. Already sugar dealers and confectioners are making their voices heard protesting against the high price they have to pay to sugar companies, who invariably agree between themselves on the price to be charged, no matter what the state of the world's sugar market may be.

Apart from the major consideration of the cost of living for the average man in Japan, there is the confectionery industry in that country which has grown within the past fifteen years to a tremendous extent and is now endeavouring to develop an important export trade with other Asiatic markets. The development of a home sugar industry in so far as beet sugar is concerned is a secondary matter, for its cultivation in the Hokkaido has not yet shown very promising results, nor, for that matter, has that in South Manchuria. In the case of the former, the cause lies in the unsuitability of the climate and the soil, most of which is heavy and not sugar beet soil at all, and the disinclination of the Japanese to work as tillers of the ground in a cold climate. There is plenty of room in the Hokkaido for Japan's teeming millions, but they prefer warmer climates and less strenuous work; nor are they willing to admit Chinese to do such work for them, though these would be quite willing to come.

So, the Japanese Government is continuing to encourage the production of cane in Formosa, in fact has made the growth of sugar cane compulsory, fixes prices, and on the whole acts in an arbitrary manner towards the natives. But credit must be given to the Japanese for the constant improvement of the plantation and cultivation system, which has led to the remarkable increase in Formosa's crops in recent years. During those years Japanese sugar interests have become of considerable importance in the world's sugar markets, buying forward and speculating perhaps even to a greater extent than others, with the result that at the time of the fall in sugar they lost heavily. The following statistics of Japan's sugar trade and industry will give one a fair idea of the position it stands in :—

PRODUCTION IN FORMOSA.

	1926 Metric Tons	1927 Metric Tons	1928 Metric Tons
Cane	4,786,861	3,994,039	5,228,130
Sugar	499,926	411,140	580,053

	Metric Tons	Value (Yen)
Exports of sugar to Japan proper	586,082	121,413,629
Other countries	7,932	1,252,784

IMPORTS OF SUGAR INTO JAPAN.

	1927 Piculs	1927 Value (Yen)	1928 Piculs	1928 Value (Yen)	1929 Piculs	1929 Value (Yen)
Under No. II standard	632,310	5,812,051	330,009	2,774,408	71,770	480,157
„ „ 15 „	3,528,536	38,390,178	106,661	1,116,365	27,608	198,091
„ „ 18 „	553,866	5,881,586	459,150	4,729,647	396,046	3,085,256
„ „ 22 „	2,003,074	22,558,738	5,361,645	55,174,977	3,186,425	26,258,631
Total including others	7,022,826	75,804,004	6,350,922	3,795,281	3,795,281	31,159,748

IMPORTS OF SUGAR INTO JAPAN BY COUNTRIES.

From—						
Dutch East Indies	5,879,517	63,307,426	6,230,002	63,702,079	3,673,640	30,354,810
Cuba	936,594	10,309,729	89,266	943,322	112,686	736,026
Philippine Islands	134,415	1,319,402	21,265	199,601	7,266	41,082
Total including others	7,022,826	75,804,004	6,350,938	64,958,583	3,795,281	31,159,748

EXPORTS FROM JAPAN OF REFINED SUGAR.

To—						
China	2,228,913	24,619,181	3,117,004	31,620,491	2,379,585	22,084,695
Kwantung Province	229,635	2,459,009	374,154	3,710,022	547,469	5,065,697
Asiatic Russia	79,735	1,611,292	221,851	2,237,117	93,354	928,039
Total including others	2,631,057	28,917,437	3,797,485	38,414,569	3,220,937	29,974,917

SUPPLY AND DEMAND IN JAPAN PROPER.

	1926 Piculs	1927 Piculs	1928 Piculs
Production	1,607,000	1,568,000	1,960,000
Consumption	12,557,000	12,957,000	14,981,000

All values in Yen. 1 picul = 132·277 lbs.

NEW COMPANY.—George Sugar, Ltd. was registered as a public company on July 26th with a nominal capital of £350,000, to establish and operate a beet sugar factory in the neighbourhood of George, Cape Province, South Africa, for refining sugar for consumption in the Union of South Africa. The Earl of Radnor is Chairman and the directorate includes Mr. A. Jarosch, of the Erste Brunner Maschinenfabrik A.G., Brunn.

ENGINEERING WORK IN MAURITIUS. In Sir Francis Watts's Report on the Mauritius Sugar Industry, it is stated that there are in that island good engineering shops, capable of making much of the machinery required for the sugar factories, including even the heavy and complicated machines and engines. The extent to which these engineering shops are capable of operating may be judged from the following list of items manufactured by them at one time or other : Mill, engines and gearing ; quadruple and triple effect evaporators ; vacuum pans ; crushers ; crystallizers ; juice heaters ; wet and dry air pumps ; maceration tanks ; barometric condensers ; cush-cush and sugar elevators ; filter-presses ; defecators ; sulphitation plants.

Recent Work in Cane Agriculture.

Report of the Committee on Varieties of Sugar Cane to the Third Congress of the International Society of Sugar Cane Technologists. **W. G. G. Moir.** 1929.

In looking over the titles of papers presented at the meeting of the International Society of Technologists last year in Java, Section C on Varieties including Propagation and Selection attracts first attention. And this is not only because the subject is one that is being pressed in all sugar cane countries at the present moment, but also because Java has been in the past and is at the present moment the scene of the greatest development in this study, and has achieved the greatest triumphs. The Section was appropriately held under the chairmanship of W. G. G. Moir, who was placed in charge of the Committee on Varieties of Sugar Cane at the Havana Meeting three years previously, and had immediately set to work on that subject with commendable enthusiasm.

He stated, in opening the Section, that two meetings of an informal character had already been held on the technique of breeding work, and therefore at once proceeded to present his Report on the work of his Committee on Varieties which had been accomplished during the previous three years. His first step was to enlarge the small Committee, tentatively designated at Havana, and consisting of known workers on the classification of canes, by making it world-wide geographically. His object was apparently to have a correspondent in each important sugar cane tract, who would be able to report at first hand on the cane varieties being grown there; and about 24 new names were added. Considering the wide extent of the country and the great number of unknown cane varieties grown there, it was natural that India including Burma should be more fully represented. Analysing the locations of the nine members with a knowledge of Indian sugar cane work, we see that Bengal, Assam and the North West Frontier Province alone are without resident representatives, though each of these tracts has its points of interest in the canes found there. It is further to be noted that no response has been received from Formosa and that there is no correspondent as yet in China. It is however of particular importance at the present time to have representatives of these countries, because of recent questions which have arisen regarding the original habitat of *Saccharum sinense*.

Moir draws attention in his Report to the great complications presented by the past literature on cane varieties. The descriptions recorded are by various writers and in different languages, and of very different value. "Many writers have attempted to straighten out synonomy of names from these meagre descriptions and have complicated the problem more than helped it. Due to this complication in nomenclature, some very erroneous ideas of certain cane varieties have been obtained by reading results published under a certain name when, in reality, they applied to some other variety." This literature of course deals especially with the older cane varieties, and it is for many reasons important that it should be studied very carefully; not only because of the rapid disappearance of many of them from cultivation, but of the increasing attention being paid to them as possible new parents in breeding work. It may be assumed that no cane variety with a wide range of usefulness can be passed over until the cause of its wide acceptance has been determined.

To remedy and counter this confusion in the literature, past, present and future, a detailed questionnaire was widely distributed at the earliest possible moment, so as to collect all the information possible on this compli-

cated subject in a sort of central clearing house, which could in future serve as a source of information for cane workers throughout the world. It was recognized that the work was long and arduous, but the great point aimed at was to make a start. The details of the questionnaire need not concern us. It was also recognized that as years pass new points may be worked out and added, and the relative value of the whole of them can be revised at intervals, with the aim of ultimate simplification; and it is only by such a questionnaire that at present the crucial points in classification can be determined. The chairman of the Committee expresses his gratification at the response accorded to his questionnaire thus far; many replies have been received, with the forms filled in with all available data; and these together with published descriptions will be held by him for future compilation. In passing, he records the sad death of a most important member of his Committee, namely, F. S. Earle "whose valuable contributions and suggestions have materially aided our progress."

The questionnaire is printed in extenso in the Report, and a list is appended of the names of the varieties and the recorders of the descriptions received—over 250 cane varieties from all parts of the world. It is somewhat surprising to note the number of canes growing in Hawaii under native names; and India, Java and Louisiana have sent many descriptions. A subcommittee has, we believe, been formed in India under T. S. Venkatraman and Noël Deerr.

The chairman of the meeting then called for remarks on the advisability of forming central collections of all cane varieties at present obtainable, for breeding purposes and study, as suggested by V. J. Konigsberger at one of the informal meetings, presumably also the better to deal with synonymy. The chief points emerging from this discussion were as follows: (1) The advisability of restricting the entry of cane varieties into any country to recognized government channels, possibly through quarantine regulations; this would prevent, it was said, individuals from bringing in canes and giving them their own names, as was being done; (2) that there should be more than one central collection, both because of the distance for the canes to travel when distributing them and of the danger of varieties being lost by disease or death; (3) that the selection of localities for the collections should be left to the standing Committee on Varieties; (4) the advisability of getting into touch with the International Breeders' Association, which is closely related to the International Institute of Agriculture in Rome. The sites proposed by different members for the collections were: Washington, which did not receive much support, Java, Porto Rico, Cuba and Hawaii.

The following resolution was passed at the General Session:—

"Whereas at the present time many identical varieties occur under different names and also different varieties are cultivated under the same name, and Whereas rational studies on sugar cane need a reliable identification and description, and Whereas cane breeding work needs the availability of all original canes and of those canes which played a part in cane husbandry, and Whereas further investigations on genetics and taxonomy of sugar cane are of prominent importance for further development of the sugar cane industry, it is Resolved that the assembled delegates of the Java meetings of the International Society of Sugar Cane Technologists recommend that in two or possibly three different countries collections should be made of all cane varieties mentioned above, and Be it further resolved that the executive committee take the necessary steps for the establishment of such collection gardens."

Parasites of Sugar Cane Moth Borers. D. L. van Dine. *Tropical Plant Research Foundation. Scientific Contributions* No. 13. 1929.

The moth borer, *Diatraea saccharalis*, is a pest of major importance in the cane fields of Cuba. It affects growth and tonnage, and entails heavy losses in field and factory ; besides, it shortens the length of life during which ratoons can be profitably reaped. And, recognizing that its parasitic enemies are among the most important factors in its control, studies have been begun at Baragua Experiment Station into all aspects of their life history. Such study is the necessary preliminary to experimental work and introductions of fresh parasites from other countries. The present paper reviews the literature available to the author on the parasites of all moth borers of the cane, which presumably is fairly complete as to Cuba, but as regards the other countries includes only the records accessible to him. This literature is summarized in two lists, one of countries, and the other of the species of parasites ; and there is a copious bibliography appended, of over 70 papers published since 1912.

Van Dine states that it is intended that the work in Cuba shall include a study of various methods, whose aim is to increase the numbers and efficiency of the parasites, both by operations in the field and by artificial propagation : and he gives the following examples of this class of work. (1) The injurious effect of burning the trash on the numbers of *Trichogramma minutum*, the egg parasite of the moth borer, which has been noted in Porto Rico and Louisiana. (2) Artificial rearing of this parasite in large numbers on the larvae of other insects than the moth borer, and letting them loose in the cane fields at the appropriate time. This has been effected in California and Louisiana through the agency of the larvae of the grain moth, the practice in Louisiana being to rear the parasites on the larvae of the grain moth in the winter and let them free in the cane fields in the spring, long before they would normally appear there. A similar method is reported from St. Vincent. Harland, in 1915, published an account of his attempt to increase the number of hosts of Trichogramma, without in any way endangering the local crops. A species of Crotalaria was found to be attacked by the caterpillar of *Utethesia ornatrix*, and this caterpillar was parasitized by Trichogramma. The growing of this Crotalaria would thus serve his purpose. (3) *Trichogramma minutum*, in the fly stage, has been noted to feed on the flowers of certain plants. As this of course is the stage in the life of the parasite in which the eggs of the moth borer are parasitized, the presence of the plants bearing their flower food should increase the number of the flies. " For Trichogramma to become established in a region it is therefore essential that its plant host as well as its insect host be present."

The importance of co-operation between countries is emphasized by a few cases in which the parasites of the moth borer have been introduced from one country to another : Cuba to Louisiana, Florida and Mexico, Central America to Porto Rico, Java to Formosa ; and steps are being taken to introduce further parasites to Louisiana from Argentina and New Guinea. The following cases may be added for the British West Indies, drawn from another part of van Dine's paper : Antigua, *Ipobracon grenadensis* from British Guiana : Barbados, *Bassus Diatraeae, Ipobracon grenadensis, Ipobracon puberulus*, and undetermined species of Ipobracon and Bassus from British Guiana : Trinidad, *Ipobracon grenadensis* from British Guiana ; British Guiana, which is particularly rich in parasites, *Lixophaga diatraeae* from Porto Rico.

A committee has been appointed by the International Society of Sugar Cane Technologists with the same general object in view. The author

however issues a note of warning. "While the writer favours co-operation in all efforts on exploration work for parasites, it is not considered that joint support and direction of such work is practical." This because, in each specific case, the necessity arises for full knowledge of the conditions both of the country to be benefited and the region to be explored, and divided interests would lessen the effectiveness of the task. "The foreign work requires great personal responsibility on the part of the explorer, and having been given such responsibility, he should also be given full authority and support for such individual effort. He should not be limited by conflicting interests, either in time, or in too much long-distance direction. Each region should assume its share of the work, directed to meet its own requirements, and by real co-operation profit by the work of all."

The lists which follow these introductory remarks of the author, and which constitute the bulk of the paper, are full of interesting matter. Their completeness is obviously limited by two chief factors: firstly, the amount of attention which has been given to the subject in different countries (and, on the whole, moth borers appear to be of less economic importance in the Old World than in the New, and the species are often different in the two cases); and secondly, the literature available to the author. These factors may or may not account for certain incongruities which attract attention as to the distribution of the parasites dealt with. While, for instance, moth borers are met with in all countries growing sugar cane, the great preponderance of parasitic species appears to belong to the New World, although the cane itself has been grown for a much shorter time there than in the Old World. *Trichogramma minutum* is recorded from practically all countries in the New World, but is only found in Java among Old World countries; and in that country there are other species of moth borer, and also other species of Trichogramma. The present intensive work is being carried on in the New World, and that in the Old World is often limited to the work of explorers sent out from the countries around the Caribbean area. Lixophaga, Apanteles, Bassus, Epibracon, Prophanurus appear to be the parasites receiving most attention, and they are all in the main New World forms. Notes on the parasitic fungus Cordyceps are also included, and we see that it has been recorded only from the New World countries. If it turns out that the comparatively rare mention in the lists of the sugar cane tracts in the Old World is owing to the study not having made in detail there, it is of great importance to the world's cane industry that this should be remedied, because of the urgent need for new forms to be brought into the fight against the moth borer.

NATURAL ENEMIES OF THE SUGAR CANE MOTH STALKBORER IN CUBA. **H. K. Plank.** *Tropical Plant Research Foundation. Scientific Contributions* No. 15. 1929.

Of the ten species of parasitic insects on the local moth borer credited to Cuba by VAN DINE, one was described in 1865, five in 1915 and the remainder since that date (which gives a useful datum for the recent development of this class of work). All but two have been met with in Baragua since the work there commenced in 1925. In the body of this paper the brief discussions of these pests are placed in their order of economic importance; further they are arranged in two groups, four being regarded as major pests, and five of minor destructiveness. A list of predatory insects met with is added, chiefly earwigs, fire-flies and ants.

The major group includes *Lixophaga diatraeae, Apanteles diatraeae, Bassus stigmaterus* and *Trichogramma minutum*. These four have been most frequently

met with and, taken together, have been observed to parasitize about half the borers in some localities at certain seasons of the year. The minor group consists of four species of Sarcophaga and one of Chaetopsis, which have been reared from larvae or pupae of *D. saccharalis*, and are considered of doubtful or of little importance in the natural control of the borer. The predators have never been noted to be any considerable factor in the matter.

Two tables summarize certain details of a preliminary survey conducted by the author as to the relative distribution of these parasites ; as judged by their collection in different parts of Cuba, and during the twelve months of the year. The first Table deals with observations on the members of the major group of parasites, during the four years 1926-1929. This list includes the parasites found in or reared from 32 centrals scattered over six provinces, and the work appears to have been of a more intensive nature in the eastern half of the country. Taking the provinces from west to east, the numbers of selected centrals were : Pinar del Rio 3, Habana 2, Matanzas 3 and Santa Clara 3 in the western half, and in the eastern. Camaguey (including Baragua) 10, and Oriente 11. Thus two-thirds of these centrals were in Camaguey and Oriente, where only one-third of the centrals of Cuba are located, though doubtless the most important ones.

Lixophaga was found in 30 of the centrals examined, and it is thought that further study will demonstrate its presence in the remaining two. In other words, it is well distributed throughout the entire island. Bassus was collected in seven centrals chiefly in the east. Apanteles in five, though it was not met with in Oriente, and Trichogramma in six chiefly in Camaguey and Oriente. The second Table serves a different purpose. It gives results of a study of all the insect enemies recorded of the moth borer met with on a single estate in Camaguey during the three years 1926-1928. The occurrence of each parasite or predator is listed for each month, and also the stage of the moth borer attacked is indicated, whether egg, larva, pupa, or adult. The only egg parasite was Trichogramma, and the only parasite found of the adult moth was Lixophaga. The great bulk were, as was natural, collected from the larva.

Lixophaga was found in the larva in each month of the year, was also collected from pupae in four months and, on one occasion, from a moth on the wing. Apanteles was only found in the larvae, and in all months excepting March and May. Bassus was met with in the larva during six months, chiefly in summer, and also in the pupa in July. Trichogramma is only listed as occurring in the eggs in March *Sarcophaga sternodontis*, the most important among the minor parasites, was found in the pupa during eight months and in the larva in one.

Interesting observations are recorded in the studies of the three major parasites of the larvae and pupae, but there are many points still to be cleared up as regards their habits and life history. The comparative rarity of Trichogramma the egg parasite, however, deserves closer attention, because this parasite is supposed to play an extremely important part in the control of the moth borer in some of the West Indian Islands. We can only conclude from the context that the search for this parasite as reported in the second Table was not made with any thoroughness. The author writes as follows : " Although reported by WOLCOTT and mentioned by HOLLOWAY as having been found at Mercedes in 1915 and 1918, this minute parasite of the eggs of Diatraea and other moths was not encountered in the present investigations until recently." During March to July in 1928 and January to May in 1929,

however, collections of borer egg masses from the leaves of young canes were made on 16 centrals, scattered over the island, to determine the range of the parasite. "The egg masses of the borer that yielded parasites constituted from 9 per cent. to 100 per cent. of the total number collected at these centrals, 31·7 per cent. being the average. One mass had only one egg parasitized."

The author's remarks raise considerable doubt as to the efficiency of this egg parasite in controlling the moth borer, not only in Cuba, but elsewhere. In Cuba the eggs collected in March and April showed higher infection than later in the year; in fact, none was found in the eggs collected in July. Although many factors might influence these results, he rightly observes that only one survival in an egg mass would be necessary to cause the death or severe injury of the stalk. In older canes it is rare for more than two or three borers to be found on the same stalk; and thus Trichogramma may only be killing those borers which would never reach maturity under ordinary conditions. This is a point of view which might well be borne in mind in all places where an abundance of this minute fly is relied on for the control of the moth borer.

SUGAR CANE—SORGHUM HYBRIDS. **R. Thomas and T. S. Venkatraman.** *Agricultural Journal of India.* *Vol.* XXV, *Part* II, March, 1930.

The authors point out that the long duration of the sugar cane crop and the heavy outlay before any profit can be reaped are serious local drawbacks as regards any extension of the area in India under this crop. Some success has been obtained at Coimbatore in producing early maturing varieties, of which Cos 214, 281, and 290 are examples. But for some time they had entertained the idea of crossing the sugar canes with some short duration cereal, if that were possible, for this purpose. The opportunity presented itself for this experiment in October-November, 1929, when POJ 2725 was the first and only one to flower about the middle of October and apparently had no pollen of its own. Its stigmas were copiously dusted with the pollen of the local *periamanjal* Sorghum, the fluff when sown gave abundant germination, and some thousands of seedlings are being nursed to maturity. These seedlings are showing considerable variations among themselves, and "certain of them are showing obvious traces of the Sorghum blood in their mode of growth and the shape, texture, and structure of the leaves. The hybrid seedlings include quite a number of albinos, not noticed in sugar cane seedlings but reported to be not uncommon in Sorghum seedlings. The albinos are dying off, while the others are growing satisfactorily. A careful examination of the Sorghum plants would appear to indicate that there do exist certain affinities between the two genera. The Sorghum stem possesses root eyes like the sugar cane and we have been able to propagate the Sorghum vegetatively by planting it like sugar cane cuttings." It will be better to reserve comment on this strange happening until the seedlings make further growth, and details are presented by the authors as to the traces of Sorghum affinity in the seedlings of POJ 2725.

C.A.B.

MR. BALDWIN ON BEET SUGAR.—Mr. Baldwin, in discussing with an agricultural gathering the means to be taken by his party to assist British agriculture, is reported to have remarked: "As to beet sugar, I have consulted some of the experts and they are agreed that we ought to grow in this country up to more than double our present acreage. I hope to see that done. I am not going to say that will be done with a subsidy, but I will say that it is perfectly obvious we shall have to examine the situation with the greatest care to see whether the industry can survive without a bounty, and, if one is essential, to what extent it is so."

Determination of Sugar by Double Polarization, using Baryta-Alumina Clarification.[1]

By JOHN H. HALDANE and NOËL DEERR.

Direct polarization, neglecting the influence of active reducing sugars, is distinguished from double polarization, which corrects for this influence by the process originally devised by CLERGET, and still known by his name. This method introduces known and recognized errors which are due to (1) the volume of the precipitate formed by the lead salts; (2) the variability of the direct reading, dependent upon the quantity of lead employed; and (3) the direct and invert readings being made in different media, the direct slightly alkaline and the invert strongly acid, the effect of which is to give a varying rotation to the reducing sugars originally present.

Processes have been put forward to eliminate these errors. The use of dry basic lead acetate, as in HORNE's method,[2] aims at eliminating the first; the second and third may be removed by double neutral polarization, as first proposed by SAILLARD,[3] and further elaborated by JACKSON and GILLIS[4]. One of us[5] has worked out a scheme which introduces strict double neutral polarization, and at the same time corrects for precipitate volume errors. The method following the modified routine due to COATES and SHEN[6] has been used in five factories during the past season. In this scheme, clarification for the direct reading is effected by the precipitation within the solution of equivalent quantities of barium hydroxide and aluminium sulphate. This inversion is made with sulphuric acid, and clarification effected with the appropriate quantities of barium hydroxide and aluminium sulphate. In this way a strict double neutral polarization is obtained, which, combined with correction for the volume of the precipitate, eliminates the errors inherent in the use of lead salts. In the statement below are collected the averages of the determinations made in five factories during the past season on mixed juice, syrup and waste molasses, the determinations given being: (1) conventional direct polarization with dry lead method (HORNE); (2) conventional double polarization (STEUERWALD[7]); (3) direct polarization, baryta and alumina, precipitate volume corrected; and (4) double polarization, baryta and alumina, precipitate volume corrected. The expression used in calculation is: $\dfrac{100\ (P - I)}{142 - 0{\cdot}0676\ (22 - 13) - T/2.}$

The order of the results given by different methods, and the differences between them, are very uniform. The only irregularity is observed in Factory 3 in which with syrup the sugar per cent. with baryta-alumina is higher than the sugar per cent. with lead. Accepting that direct polarization with lead is the most commonly used method, and that double polarization with baryta-alumina gives results least incorrect, the error amounts to 0·68 per cent., an exactly equal error being introduced if the conventional double polarization method with lead be used. Dependent on the point of view, this error is trifling or serious. When the best controlled factories show an unknown loss of 1 per cent., an error of 0·68 per cent may be regarded as of no great importance. On the other hand, 0·68 per cent. on 10,000 tons of sugar represents 68 tons. A loss of this order in sugar which had once been credited to stores account would not be lightly regarded; yet a loss obscured by incorrect methods of analysis is equally real, though not equally

[1] Paper (here slightly abridged) published in the Proceedings of the Third (Java) Congress of the International Society of Sugar Cane Technologists.
[2] *J. Amer. Chem. Soc.*, 1903, **26**, 186. [3] Trans. 8th Intern. Congress Appl. Chem.
[4] *I.S.J.*, 1920, 509, 570, 638. [5] *I.S.J.*, 1915, 179. [6] *Ind. & Eng. Chem.* **20**, 70.
[7] *Archief*, 1913, **21**, 1383; *I.S.J.*, 1913, 489.

readily realized. A few determinations on waste molasses have been made with invertase using the preparation "Invertase Scales Red Label." These

		(1) Lead Direct Pol.	(2) Lead Double Pol.	(3) Baryta Direct Pol.	(4) Baryta Double Pol.
Mixed Juice.					
Factory	1	12·51	12·70	12·43	12·59
	2	11·36	11·65	11·25	11·46
	3	10·32	10·48	10·29	10·45
	4	10·33	10·46	10·27	10·43
	5	12·05	12·18	11·98	12·08
Mean		11·31	11·49	11·24	11·40
Syrup.					
Factory	1	49·71	50·36	49·52	50·03
	2	48·86	49·93	48·51	49·20
	3	47·71	47·96	47·51	48·14
	4	45·65	46·18	45·37	46·06
	5	40·36	41·11	40·03	40·78
Mean		46·46	47·10	46·19	46·84
Waste Molasses.					
Factory	1	35·24	36·10	34·84	35·61
	2	34·93	37·47	33·16	35·49
	3	34·95	36·09	34·04	35·84
	4	32·96	33·92	30·88	33·65
	5	32·83	36·07	31·25	35·33
Mean		34·18	35·93	32·83	35·18

agree within experimental error of observation with those obtained with acid inversion as above. This process which entails only one clarification operation, and eliminates the preparation of one solution seems the most desirable routine, and will be further examined when occasion permits.

Corrosion Resisting Steel.—Steel manufacturers are now selling special corrosion resisting alloys offering remarkable resistance to many chemical reagents, while at the same time possessing mechanical properties which render them widely serviceable and capable of being worked into a great variety of forms. They are supplied in the form of castings, forgings, sheets and tubes.

Training Technologists.—Arrangements have been made by the South African Sugar Technologists' Association for the training of young sugar-house workers at the Natal Technical College, a 4-year schedule of studies having been drawn up. Mr. J. Rault, of Natal Estates, Ltd., will conduct the technology classes, and other estates will probably assist by loaning the services of well qualified members of their staff. In addition to classes in chemistry, physics, mathematics, agriculture, engineering, and sugar technology, it is hoped to train men in the use of the new Locking system of factory accounting, which will probably come into considerable prominence in the near future. On the completion of the third year, students will sit for the Grade I Examination of the City and Guilds of London Institute, and in the fourth year they will be prepared for the Final Examination.

Advertising Sugar.—The Sugar Institute in the U.S. has for over a year been carrying on a wide-spread advertising campaign for the purpose of overcoming the hostile attitude of the general public towards sugar. Quiet, persuasive advertisements, stating the truth from start to finish about sweets, were placed in hundreds of publications, every one of them having previously been approved by a group of foremost doctors, food chemists and dentists. A booklet illustrating these clever, telling displays in favour of the virtues of sugar was recently published. This propaganda must have gone far towards enlightening the public of that country on the proper use of sugar. In planning the campaign for 1930, more emphasis has been placed on the importance of sugar as a flavour to make wholesome foods more enjoyable. Such efforts to increase consumption might well be imitated in other countries.

Beet Agricultural Notes.

MINISTRY SUGAR BEET INVESTIGATIONS.

The series of demonstrations, begun in 1927, and carried out in 1928,[1] were continued in 1929. Their object was to deal more specifically with the problems of plant population, manuring, and varieties. The severe winter frosts enabled a fine tilth and good seed bed to be obtained. Where rain fell between drilling and singling time, germination was regular, but in some districts the drought delayed it. The subsequent great drought did not, except on the lighter soils, prevent the realization of a heavier yield of beet per acre, with a consistently higher sugar percentage, than in the previous two years. The fine weather during the earlier period of lifting enabled the bulk of the crop to be harvested under good conditions, thus reducing the cost of operations and of dirt tare. As a rule, the response to artificial manures was satisfactory despite the drought.

General Results.—In general, the results support the conclusions arrived at in the previous years' reports, but no significance can be attached to the statistical data. The returns, if looked upon as empirical, and relating only to the district or centre from which the results were obtained, provide, in conjunction with the investigator's interpretation, information of local value only. It is impossible to assess variations in yield quantitatively, with any degree of reliability, under a scheme which lacks the precision of a scientific experiment or a sufficient number of centres to mitigate or counteract the inconsistent factors which arise in attempting to make comparisons. It is only necessary to mention the possible influence on the result of such factors as variety, dates of sowing and singling, differences in plant per acre, and previous manuring and cropping. In the past year the value of a good tilth produced by natural conditions, associated with the climatic influences which provided regular germination, good growth, a higher sugar content and a clean and dry lifting time, tends to indicate that these factors, together with what is known as "fertility," or land in good heart, are the dominant factors in beet cultivation as with all other crops.

Inter-Row Widths and Spacing.— When they are considered separately, the district results indicate as in previous years that the narrower rows provide the higher yields, but the variation in row widths and singling distances prevents even an arithmetical mean or average being taken from the collective returns. The consensus of opinion favours the narrower inter-row width of not more than 20 in., with singling to a distance of 10 in. The results, however, are not sufficiently uniform to provide conclusive evidence on the point. The cost in the Essex investigations of manual and horse labour from drilling up to, and including lifting, with 17 in., 21 in. and 24 in. work is shown to be £3. 4s. 2d., £1. 12s. 8d. and 15s. 9d. per acre respectively more than the cost on 28-in. work.

In Norfolk to eliminate the effect of plant population per acre, an attempt was made, by controlling the rate of seeding and by singling to a measured distance, to leave the same number of plants per unit area, namely, 30,000 plants per acre. The result emphasizes the extreme difficulty of eliminating a normally variable factor under field conditions. In only six cases out of thirty-four were the number of beets lifted within 500 of the anticipated 30,000 plants to the acre.

Nitrogenous Manures.—About three cwt. per acre may be regarded as the optimum quantitative dressing. The general findings of previous years, that the best time of application was at seed time, was not borne out at all

[1] *I.S.J.*, 1929, 497.

centres in 1929, but this effect may be attributable to the unusual climatic conditions and the fact that in the absence of sufficient moisture the early applications were not fully used. The highest increase in yield was given by nitrate of soda in one district, by nitro-chalk in the second and calcium cyanamide in the third. Nitrate of soda appeared to produce higher yields than sulphate of ammonia.

Mineral Manures.—These investigations were confined to fen soils, and confirm the findings of previous demonstrations, namely, that dressings of superphosphate up to four cwt. per acre give the greatest increase in weight. On black fen soils which are naturally fertile, complete dressings of artificials show little response. Where comparisons were made between different forms of phosphatic manures, superphosphate gave better results than either slag or steamed bone flour.

Varieties.—The trials of varieties are inconclusive. It is not thought necessary to include in this note the reports of the local results, since these must be regarded as of local significance only, but those who require detailed information of these results should apply either to the Ministry or to the Agricultural Organizer of the County in which the work was done. The counties which co-operated in the investigations were Cambridge, Essex, Kesteven, Lindsey (Lincs.), Norfolk, Nottingham, Shropshire, East Suffolk and Yorkshire.

ACID TREATMENT OF BEET SEED.

The treatment of beet seed by sulphuric acid has been investigated in Germany for the control of *Phoma betae*, it being found that germination appeared to be benefited, though no attempt was made to determine the superiority numerically. In recent work by F. HANLEY and R. M. WOODMAN[1] work was undertaken in this direction, the idea being to crack the seed clusters and thus expose the actual seeds, mechanical means to do this having failed. In one series of experiments, for example, 250 grms. of Kleinwanzleben seed were covered by sulphuric acid (80 per cent.), allowed to remain for 5 min., when the seed had become well wetted and charred ; then the acid was drained off on a Buchner funnel, and the seed washed vigorously with water, next with 1 per cent. sodium hydroxide, and again with water. Lastly it was spread out on filter-paper to dry ; later germination tests were made with this seed, also with seed soaked in water for the same time, and again with untreated seed. As the result of these experiments, and of others, the authors found in all cases a statistically significant difference in favour of the acid treatment. Such treatment increased not only the rate of germination, but the total useful percentage germination, and also the total number of seedlings from a given number of seed-clusters alive at singling time. The acid treatment caused no reduction in the average size of seedling, but rather the contrary. Since the germinative capacity of the seed clusters was not reduced by acid treatment, the fact that the acid treated seed contains a greater number of seed-clusters per gramme must obviously lead to the production of a greater number of seedlings from a given weight of seed. From this viewpoint, therefore, the use of acid treated seed may be regarded as equivalent to using a 40 per cent. heavier seed-rate. When, further, the seed-rate is adjusted so that the same numbers of seeds are sown per acre, the acid treated seed will still produce a better "plant," the germinative capacity being increased by the acid treatment. Water-soaked seed germinated better than the untreated material, but the difference was not generally significant.

[1] *J. Soc. Chem. Ind.*, 1930, **49**, No. 19, 215-220T.

Beet Agricultural Notes.

IRISH BEET CULTURAL EXPERIMENTS.

The report on the sugar beet experiments conducted in 1928 by the Department of Agriculture for the Irish Free State has just been issued, and will be of interest to all beet-growing farmers.[1] The results, it is true, to a large extent confirm similar experiments in England, but they are worth a brief mention if only to remind farmers of certain outstanding cultural facts. The first finding to be noted shows that the standard dressing of 4 cwt. superphosphate, 4 cwt. kainit, and 1 cwt. sulphate of ammonia per acre applied immediately before sowing has proved generally more satisfactory than any modification of it. An *additional* application of 15 per cent. of the dressing, however, gave a profitable increase, so that, where the outlay can be afforded and other general conditions of soil are favourable, an additional 25 per cent. of the standard dressing is worth trying. Further trials as to the best quantity of the standard dressing for general use are, however, proceeding, and the report recommends that, pending final conclusions, the quantities stated should be used, in addition to a top-dressing of 1 cwt. nitrate of soda per acre a few days after the crop is singled. The 1 cwt. of nitrate of soda can be given even before singling where the crop is attacked by insect pests, or where growth has been retarded by adverse weather.

The next finding of the Report is that a dressing of sugar factory waste lime at the rate of 4 tons per acre in the autumn and winter, prior to sowing, increased the average yield of roots and the sugar content only very slightly. This is contrary to a belief that has found currency that such waste lime is very useful dressing. The trials show that a waste lime-dressing may produce a profitable increase when the soil is deficient in lime, but that ordinary burnt lime may, in such a case, prove more economical. The next concerns storage of beet. The experiment showed that there occurred in beet stored over a period of 8-10 weeks in an ordinary narrow clamp with straw, a decrease of sugar amounting to about 6 per cent. of the total weight of sugar in the beet. The next finding deals with the making of silage from the beet tops, either alone or when mixed with beet pulp. It seems that the making of silage involves considerable risk of loss, and that, at any rate in Ireland, it is usually more economical to feed the tops in the fresh condition. Then follow three items which have been proved in beet cultivation. First that the *time* of the application of farm-yard manure, whether during the winter or with the drills in the spring, has no appreciable influence on the yield of beet, or on the sugar content, or on the shape of the roots. Second, that the best crop results are obtained when the drills are 21 in. or less in width and when the plants are singled to approximately 9 in. apart. Third, that better results are obtained when the plants are singled at the four-leaf stage, than when singled at either an earlier or later stage of growth.

FACTORS INFLUENCING THE QUALITY OF BEETS.

In a discussion on "Soil Composition as related to the Composition of Sugar Beets," H. W. DAHLBERG, Research Manager of the Great Western Sugar Co., placed the chief factors influencing the quality of the beet as follows: (1) Climate ; (2) soil and cultural practices ; and (3) heredity. The unusually fine quality of beets grown in northern latitudes is certain and definite whether we speak of North America or Europe. Beets grown in northern Italy at about the same latitude as southern Montana, but with a much warmer climate, average only 13 per cent. sugar. Czecho-Slovakia, in the same latitude as

[1] From the Ministry of Agriculture, March 28th, 1930.

Winnipeg, Canada, raises beets of 18 per cent. sugar and high purity. Southern Sweden, in the same latitude as Hudson Bay, has the finest beets anywhere in the world, sometimes as high as 20 to 21 per cent. sugar, and 90° purity. Some might say that the soil in these northern latitudes is perhaps so different in composition that this would account for the variation. In order to prove this point, an enterprising Italian sugar manufacturer shipped a carload of Italian soil to Czecho-Slovakia and a carload of Czecho-Slovakian soil to Italy. In both countries the same seed was grown side by side in Italian and Czecho-Slovakian soil. The results in Czecho-Slovakia were as follows: The purities of the beets were the same but the sugar content of those from the Italian soil was 17·75 per cent. compared with 17 per cent. in the local soil. In other words, Italian soil which produced very poor quality beets down south had no difficulty in producing beets of excellent character when the soil was transported north. While the growing season is shorter in number of days, the number of working hours per day is greater. If we compare the total hours of daylight at Denver with East Grand Forks, we find that the latter has from 1½ to 2 hours more daylight per day during the months of June, July and August. This does not mean that they have that much more sunshine. It is becoming more and more evident that diffused light such as we have before sunrise and after sunset is a very desirable form of light for developing sugar content. Having more working hours of daylight, the beet has time to really ripen by using up the available nitrogen in the soil. The time when a beet becomes ripe is when it has used up the available nitrogen, and this time is characterized by the yellowing of the leaves. The time of ripening can be delayed by using either excessive quantities of manure or by applying a nitrogen fertilizer during the growing season.

MISCELLANEOUS.

Beet Tops as Fodder.—Trials in bullock feeding on sugar beet tops and pulp have been carried out during the past three years on the farm of the Norfolk Agricultural Station, and the results obtained are summarized by S. T. JOHNSON.[1] In 1928, due to the severe frosts, and to other conditions, the value of the material was probably below its average level. In 1929, however, the use of ground chalk appears to have prevented the recurrence of the souring which was a troublesome feature of the first week or two in the 1928 trial. The animals eating the tops in the 1929 season always looked well and their live weights confirmed their appearance of thriftiness. Lime, in one of the forms in which it is placed on the market for feeding purposes, should always be included in the diet of bullocks when sugar beet tops are being fed. Tops undoubtedly possess considerably manurial value when ploughed down, but it is quite obviously wasteful to use them in this way, since their manurial equivalent can be purchased very much more cheaply than their food equivalent.

MAXWELL-BOULOGNE SCALE.—Those interested in improving methods of chemical control should note that this simplified juice scale is claimed to be not only the most accurate automatic scale, but the most moderately priced apparatus of its kind. A Certificate received from the Java Experiment Station stated that "It is the most accurate weighing machine which exists; it is perfectly mechanical and automatic and needs no supervision. Its construction is so strong that it will, for years, need no repair." There are no fewer than 59 of these juice scales working in Java, weighing raw juice, imbibition water, syrup, molasses and diluted filter-mud.[2]

[1] *Journal of the Ministry of Agriculture*, 1930, 37, No. 3, 210-211.
[2] Data from a recent advertisement.

Publications Received.

The Measurement of Hydrogen-Ion Concentration. Julius Grant, Ph.D., A.I.C. With illustrations and diagrams. (Longmans, Green & Co., London). Price : 9s.

After consulting the standard works on hydrogen-ion determination, many must have felt that a book dealing more directly and more practically with the subject was rather to be desired. In this small volume they will probably find their requirements met. It gives the shortest and simplest account of the theoretical side consistent with the needs of the worker. On the practical side, it gives a good account of the electrometric method, describing the preparation of electrodes and cells, the setting up of apparatus, and the actual making of measurements. An easily constructed nomograph for the translation of millivolts into *pH* values or the reverse is here shown. Regarding the colorimetric method, much useful information is given, particularly in dealing with the preparation of indicator and buffer solutions. Directions are given for making up permanent colour standards, using cobalt nitrate, potassium dichromate, and copper sulphate, which are said to keep definitely. However, these and other colour standards, as those made of transparent strips impregnated with the indicator, must be used with caution. In fact, it is pointed out, the electrometric method should always be used for checking purposes, especially of buffer solutions, and is indispensable in the determination of hydrogen-ion concentration where accuracy is required.

Handbook of Chemistry and Physics. By Charles H. Hodgman and Norbert A. Lange. Fourteenth Edition. (Chemical Rubber Publishing Co., of Cleveland, Ohio, U.S.A.). 1930. Price : $5.00.

Previous editions of this "Handbook" have been noticed in these columns from time to time, when we have drawn attention to the immense amount of accurate, important, and up-to-date information which it contains. We are familiar with the latest editions of ATACK's "Chemists' Yearbook," the "Chemiker Kalendar," the "Tables Annuelles de Constants," and others, but this compilation is certainly the most complete of all, so far as chemical and physical data are concerned. Methods of technical and commercial analysis, such as form a useful feature of ATACK's book, however, find no place here. It is purely a collection of definitions, constants, tables and miscellaneous information, arranged under the following headings : Mathematical Tables ; General Chemical Tables ; Properties of Matter ; Heat ; Hygrometric and Thermometric Tables ; Sound ; Electricity and Magnetism ; Light ; Miscellaneous Tables ; Definitions and Formulae ; Laboratory Arts and Receipts ; Photographic Formulae ; Measures and Units ; Wire Tables ; and Problems in Chemistry and Physics. As a *recueil* of such information, by reason of its remarkable completeness, it is unique. Such a volume is not a luxury to the chemist engaged in investigation work in the sugar factory or refinery laboratory, but a necessity.

Studies on the History of the Russo-Ukrainian Sugar Industry. By Prof. C. Wobly. Vol. II. 1861-62 to 1894-95. In Russian. (Académie des Sciences Oukaïnienne, Kiev, rue Korolenko, 54. 1930.

Contents : General characteristics of the policital economy in Ukrainia during 1861-1895. The beet sugar industry before the freedom of the serfs up to the year 1881-82. Development of the beet sugar industry during the period 1881-82 to 1894-95. The territory of the sugar industry in 1861-62 to 1894-95. Changes in the process of cultivation of the beet and its harvesting during 1861-62 to 1894 95.

The Porto Rico Sugar Manual. By A. B. Gilmore. Post 4to., 280 pages. (A. B. Gilmore, 600 Godchaux Building, New Orleans). Price $10.00.

This is a new addition to the list of Gilmore Manuals, and deals exhaustively with both the Porto Rican and Santo Domingan sugar industries ; details include Ownership, factory location, operating personnel, machinery equipment, transportation facilities, sugar production, etc. A front section of the manual is devoted to the presentation of all the formal addresses delivered before the 1929-30 annual meeting of the Association of Sugar Technologists of Porto Rico, together with a few special individual contributions to the manual from Porto Rican technologists.

Brevities.

Colloid Elimination.—J. S. Paine, J. C. Keane and M. A. McCalip of the U.S. Bureau of Chemistry have stated that[1] "the colloid elimination by dye test was distinctly greater in double defecation, which method also gave a larger rise in apparent purity as well as a slightly better general appearance." This double defecation is an important function of the Petree Process, by which colloids are eliminated to a maximum extent. This means easier filtration for the refiner.[2]

Acid-Proof Cement.—What should prove to be very useful material for sugar factories is an acid-proof cement which has been employed in the heavy chemical industry for some time, and known to be reliable. Ordinary concrete being attacked by sugar juices and syrups, and deteriorated before very long, this special cement should prove of much use for the flooring around the mills, filter-presses, and elsewhere. It sets hard, carries heavy loads, and adheres to iron, stone, brick, etc. It withstands all acids with the exception of hydrofluoric, at any temperature; and is unaffected also by weak alkalis. It is quite suitable for the economical construction of storage tanks for molasses, and the like.

Sugars for Egg Preservation.—It is known that when egg batter containing the yolks is frozen without the addition of a suitable protective agent, the egg structure is broken down, and the thawed batter is watery and ropy. Sugars are the most common of the protective, non-coagulating agents used in this freezing process of preserving eggs. O. M. Urbain and J. N. Miller[3] now find that the coagulation of the lecithin may be prevented by the addition of 10 per cent. of dextrose or levulose (by weight), either of which is much more effective than sucrose. These two sugars also show an advantage over sucrose from the standpoint of the fermentation and bacterial decomposition of the thawed batters.

British Empire Trade Exhibition at Buenos Ayres.—The British Empire Trade Exhibition which is being held in Buenos Ayres in 1931 will be open from March 14th to April 27th. It is intended to be truly representative of the British Empire and only British articles are eligible. The British Chamber of Commerce in Buenos Ayres is prepared to give all assistance possible to firms not already represented, in finding agents, and early correspondence on this subject is invited. The Customs is allowing all goods to be imported free of duty into the exhibition provided they are re-exported after it closes. The London address of the Exhibition promoters is at 5, Parliament Mansions, Orchard Street, S.W.1; and the Argentine address is at Calle Reconquista 46, Buenos Ayres.

Waste Wood Utilization.[4]—About 400 tons of scrap wood, produced per day at the plant of the Ford Motor Co., Iron Mountain, Mich., is subjected to destructive distillation in Stafford vertical retorts, operating continuously while using the heat developed by the exothermic carbonization. Final products that are obtained include, in addition to charcoal and incondensible gases (which are burned under the boilers and used for heating up retorts), C.P. methanol, methyl acetone, allyl alcohol, ketones, methyl acetate, soluble tar, pitch, creosote oil, ethyl acetate, and ethyl formate. The finished products are of standard purity, and are disposed of on the chemical market, except the ethyl acetate, the production of which is largely utilized in making the lacquer finish and artificial leather for the Ford car.

Cane Ripeness.—As an indication of the ripeness of the cane, the dry substance as determined rapidly by means of a refractometer is now being much used, especially in selection work. Ordinarily a small piece of cane cut out without destroying the stalk is crushed between the jaws of an ordinary pair of pliers, and the juice thus obtained placed between the prism surfaces. Mr. A. Garcia, of Bais Central, P.I., however, has devised a kind of lancet, which is much more conveniently manipulated. It is really an awl with a rather deep straight groove running from the point to the hilt. It is simply inserted with steady pressure into the part of the cane to be sampled, usually pointing obliquely upward. Several drops of juice immediately run down the groove, the lancet is withdrawn, and the liquid run between the refractometer prisms by gravity. It is a practical little instrument.[5]

[1] *I.S.J.*, 1928, 31. [2] Data from a recent advertisement. [3] *Ind. & Eng. Chem.*, 1930, 22, No. 4, 355-356. [4] *Ind. & Eng. Chem.*, 1930, 22, No. 4, 312-315. [5] *Sugar News*, 1930, 11, No. 5, 240-242.

CITRIC ACID.—Articles and patent literature have been published of late on the production of citric acid from sugar solutions.[1] Natural citric acid is largely produced in Italy, and efforts are now being made (it is reported) to concentrate production in that country in one centre, and to adopt other means, with the object of better meeting the severe competition of the synthetic material, now being manufactured in Belgium and in America.

SUGAR FOR FATIGUE.—Prof. Donald A. Laird, Director of the Physiological Laboratory, Colgate University, Hamilton, New York, has carried out detailed experiments on students on the value of sugar in resisting fatigue, concluding that: "Workers who find it necessary to stay awake when they would normally be in bed can greatly offset the feeling of fatigue that comes during the night and on the day following by indulging in a sweet snack in the form of sweetened drinks, candy, or any other food that contains sugar."

METRIC UNITS FOR CHEMICAL CONTROL.—Dr W. E. Cross, Director, Sugar Experiment Station, Tucumán, Argentina, wrote to the Java Congress: "If we are to have international systems of chemical control, it is necessary that these be based upon a uniform unitary system, and this should of course be the metric system. At present it is practically impossible to compare the results of one country with those of another without making elaborate calculations to reduce the reports to the same units . . . . . I think the adoption of metric units exclusively is a *sine qua non* for any attempt to put chemical control of cane factories on an international basis."

SYNTHETIC ALCOHOL.—"To your directors it appears inconceivable that the use of molasses can ever be replaced by substitutes or by synthetic processes. Molasses is a by-product that will continue to be produced irrespective of the price at which it can be sold, for the simple reason that sugar cannot be manufactured without producing molasses. We feel satisfied that synthetic alcohol can never do more than prevent molasses prices from rising beyond economic limits, and a regulating factor of this nature would benefit rather than endanger our business. The world at the moment produces about 27,000,000 tons of sugar per year and the total production of molasses is six to seven million tons, of which we handle approximately one-third."[2]

BAGASSE UTILIZATION.—In Hawaii a company having an authorized capital of \$10,000,000 is being planned for the manufacture of wall-board and possibly other products. It is taking over a concern known as Hawaiian Cellulose, Ltd., and is supported by influential local business men. Particulars have now been published of the manufacture of "Mazolith" moulding composition from cornstalks and corncobs,[3] the process being briefly to cook with caustic soda, beat to a jell, and dry. It is a dense, hard bone-like substance, having satisfactory electrical properties. Using cornstalks as raw material it can be produced in a small plant for \$240 per ton. Other fibrous substances, including no doubt bagasse, can be used for the manufacture of this insulating material.

FINE GRAIN SUGARS.—Refined sugar of very fine grain has heretofore been supplied by refiners by disintegrating and sifting. But recently in the U.S. the attention of technologists has been directed to the Varnau-Wayne process for the direct production of such a fine product.[4] Syrup or liquor, prepared by concentrating high-grade char-filtered liquors in effects and finally in a finishing pan to a solids content of 80-85 per cent., is cooled with great rapidity by introducing it in the form of mists or films into an air or vacuum chamber (the "grainer") under pre-determined conditions of control to effect a rapid temperature drop. This causes the spontaneous appearance of a very thick grain setting. A very full account of the process was recently given in our Patents Review.[5] Advantages claimed are that large yields are obtained; the time element in graining is eliminated; fuel is saved, and the process is continuous and nearly automatic. Fine grain sugar made by the Imperial Sugar Co., of Sugar Land, Texas, by this process is being marketed in the U.S. under the name of "Banquet Ultra Refined Sugar."

[1] *I.S.J.*, 1929, **97**, 172, 672.
[2] Mr. F. K. KIELBERG (Chairman and Managing Director) at the last annual meeting of United Molasses Co., Ltd.
[3] *Miscellaneous Publications No. M*-108; by C. E. HARTFORD; published by the Bureau of Standards.
[4] *Facts about Sugar*, 1930, **25**, No. 21, 520. [5] *I.S.J.*, 1929, 448; 1930, 333.

Review of Current Technical Literature.[1]

Reports on Factory Equipment in Natal. *Proceedings of the Annual Congress, South African Sugar Technologists' Association*, 1929.

A number of questions were sent out to sugar factories in Natal, and the results are here summarized, though it is to be remarked that the returns show very wide variations. *Mills.*—Tons of cane crushed per hour, 21·5 to 40. Fibre in cane, per cent., general average 15·4 to 17·0, one factory, however, reporting 18. Whether cane knives are used: 7 out of 10 factories stated these preparatory appliances were employed. Benefits from cane knives: in general, better feed, increased capacity, and (in 2 cases) higher extraction. Milling equipment: 7 out of 13 factories have Krajewskis, with 3 or 4 sets of mills, generally 4; four have double crushers. Capacity based on cane of 14 per cent. fibre: mills using Krajewskis report from 40 to 65 tons; and the double crushing factories, 85 tons. Maceration: 20 to 30 per cent. *Boilers.*—Heating surface in sq. ft. per ton cane hour: Average about 300 to 450, though one factory reported only 140, and another 281. In replying as to the b.h.s. necessary (*a*) for mill white and (*b*) for 96°, one factory reported (*a*) 380 and (*b*) 450, another (*a*) 400 and (*b*) 490, and another (*a*) 450 and (*b*) 550. Grate area per sq. ft. of heating surface: 1 to about 75. Water-tube or fire-tube: fire-tube mostly, and in some instances both. Economizers: 2 use them out of 11 factories. Preheaters: 2 out of 11 use them, the Howden-Ljungstrom being reported as "very good," and the "NOCO" as giving 12 per cent. increased steam pressure. Supplementary Fuel: 3 out of 11 use none; 6 coal and 2 wood.

Juice Scales.—Out of 12 factories, 3 do not use them; one uses the Maxwell-Boulogne, and one the Richardson; while the rest use the Howe. Maceration water, 3 weigh, one uses a meter, and the rest calculate from the volume. *Juice-heaters*: Type, 3 out of 12 use both vertical and horizontal, 5 vertical only, and 4 horizontal only; average capacity in sq. ft. of N.S. per ton cane, 58. *Clarifiers and Subsiders*; Type, out of 12 replying 1 uses Petree subsiders, two have Dorrs, and the rest ordinary rectangular subsiders with or without coils. Ratio of volume (in cub. ft.) per ton of cane per hour considered necessary for Dorrs: the figures is returned at 1 : 200 and 1 : 723; for open rectangular apparatus, those replying gave 1 : 85, 90, 100 and 130. *Filter-presses*: Capacity of mud settling tanks per ton cane hour, from 16 to 60; one factory considers 20 necessary, and another states 80, say 40 as average. Ratio of filtering area per ton of cane per hour necessary for mill white: 80 to 175 (but one factory returns 286); and for raws, 57 to 175. Two use the hydraulic closing device on their filter-presses. Scum pump: 5 state they are using the Cameron, its capacity varying from 4000 to 8000; five use *monte-jus*. *Pre-Evaporator*: One factory only uses a pre-evaporator; 4 have triples, 8 quadruples. Heating surface per ton cane hour: for triples 250 is considered necessary, and for quads 300 to 350. Average density of (*a*) juice and (*b*) syrup: these returns vary from (*a*) 14·8 to 18·6 and (*b*) from 45 to 58° Brix. Save-all: 10 of the factories stated they have no special type, one has McNeil's patent, and the 12th returns "counter-current-type." *Vacuum Pump*: Cub. ft. per min. displacement per ton cane hour, 32 to 59 is considered necessary. *Pans*: All factories replying express preference for calandrias, excepting one which uses coil for making large grain sugar. Total h.s. per ton cane hour: the average for calandrias appears to be about 60 (though the returns here again vary considerably); and for coils, 15 to 30. Ratio h.s. to volume for calandria pans, 1·5 to 1; and for coils, 1 to 1. Heating surface per ton cane hour necessary for (*a*) mill whites is returned as 60 to 100; and for (*b*) raws, 40 to 75. *Crystallizers*: Cubic capacity per ton cane hour for (*a*) No. 1, (*b*) No. 2 and (*c*) low grades: one factory returns (*a*) 60, (*b*) 90 and (*c*) 200; another, (*a*) 90, (*b*) 128 and (*c*) 316; and another (*a*) 122, (*b*) 285, and (*c*) 320. *Centrifugals*: Sieving area in sq. ft. per ton cane hour, in the case of raws (*a*) for 96°test, 2·5 and (*b*) low grades, 5·0. In the case of whites, the total average is about 7 also. Type of centrifugal linings: 5 use Fontaine throughout; one spiral woven, the others perforated sheet. *Sugar room*: All the factories use platform scales; and 5 state they are not in favour of automatic scales, being said to be unreliable.

Review of Current Technical Literature.

CANE GRINDING AT HIGH SPEEDS (IN CUBA). **J. R. Mayo, Jr.** *Proceedings of the Third Annual Conference of the Association of Sugar Technologists of Cuba*, 1929.

In 1915 Mr. JULIO MARCELIN in a well-known central in Camaguey Province reached a speed at the mill engines of 80 revs. per min., the rolls of the first, second, and third (and last) mills of the two tandems developing a speed of 40, 42½ and 48 ft. per min. respectively, then an extremely high grinding coefficient. At the same time, the extraction compared well with that being obtained by the majority of Cuban mills. Later, the author took the matter up, and realized that with the appearance of greater pitch grooving the opening of the mills should be reduced greatly, while considering the setting of the crushers and the amount of cane to be ground. In a 19-roll tandem provided with knives he has been able to grind 330,000 arrobas (3683 long tons) obtaining 95 per cent. extraction with 8-10 per cent. imbibition, the peripheral speed of the last mill being 42 ft. per min, with the third and fourth in proportion, the three being driven from the same engine. The speeds of the first and second did not exceed 30 and 34 ft., due to the ratio of the gearing and the general arrangement of the equipment. During the last idle season the gearing of the last three mills was modified, so that during the crop the speed of the last three mills was greatly increased, while the settings were closed and careful attention given to laboratory reports. At the last mill a maximum speed was attained of 53 ft. while grinding 360,000 arrobas (4017 long tons) of cane per day, and reaching an extraction of 95·5-95·8 per cent. with 8-10 per cent. imbibition, and this in spite of the fact that the first and second mills had to be opened up to give passage to the body of cane. It should be noted here that the power required per 100 arrobas of cane increased 10 per cent. with relation to an increase of 25 per cent. in the speed of the rolls, in spite of the fact that the hydraulic pressure had been reduced 25 per cent. So much for the practical results obtained. Looking at the matter from the theoretical point of view, it will be seen that the time the bagasse is subjected to compression when passing through a mill depends naturally on the peripheral velocity of the rolls and the distance covered by the bagasse while subject to such compression. The principal objection raised against grinding at high speeds seems to be that this brings about as a corollary a reduction in the duration of the time of compression, thereby increasing the possibility of re-absorption, and thus giving insufficient time for all the juice to escape from the cells, counterbalancing in fact the advantages obtained from the greater permeability of the blanket due to the corresponding diminution of its thickness. But the peripheral speed is a function of the angular velocity (revs. per min.) and of the diam. of the rolls, the effect of which latter can be seen from the following example: Assuming the bagasse blanket to have a thickness of 12 in. at the commencement of the period of compression, and the distance between the rolls to be ½ in., the peripheral speed and the amount of cane ground being equal in both cases; then the rolls of 36 in. diam. will give a compression interval approximately 5½ per cent. greater than that obtaining with rolls of 33 in. diam.

THE VAZCANE PROCESS. **Geo. M. Seidel.** *Industrial and Engineering Chemistry*, 1930, **22**, No. 7, 765-768.

In an article by EARL L. SYMES[1] a very full account was given of the process being tried out in Cuba for the utilization of bagasse for the production of fibre board. This present article gives some further particulars of the plant used, and in particular gives the following data on costs : " A good idea may be obtained of the merits of the process by a comparison of the raw-material costs and the power consumption in stuff preparation in the Vazcane process with similar industries, since the other manufacturing costs are more or less the same. Since the present use for bagasse is as fuel for steam generation, the value of the fuel needed to replace bagasse may be taken as its raw-material value. KERR[2] gives an evaporation of 2¼ lbs. of water from and at 212°F. per lb. of wet bagasse fired. The average of

1 *I.S.J.* 1929, 645. 2 Kerr, Kents' Mechanical Engineers' Pocketbook. 8th ed., p. 810.

three boiler tests given in "Steam"[1] is 2·47 lbs. water evaporated from and at 212°F., the average moisture content being 49·2 per cent. With the existing low-pressure boilers in use on the sugar estates, good Cuban practice obtains an evaporation of 12 lbs. of water per lb. of fuel oil. Using 2·5 lbs. as the equivalent of bagasse, then 1 lb. of fuel oil would replace 4·80 lbs. of bagasse. One ton of fibre is equivalent roughly to 2 tons of bagasse, so that 4000/4·80 or 833 lbs. of fuel oil is the fuel necessary to replace 1 ton of fibre, or 2·48 barrels. At $1·50 per barrel the cost is $3·72 per ton. This cost represents that total raw-material cost, since there is no handling or storage charge in addition. The power consumed was 18·3 kilowatts per ton of dry fibre per 24 hours. The power consumption chargeable against the production of board, however, is less, as in any event a certain power consumption must be charged against the production of sugar. In ordinary milling the power consumption is 0·5 kilowatt per ton of cane per 24 hours. On the basis of 10 per cent. fibre, this represents 5·0 kilowatt per ton of fibre per 24 hours, leaving a power consumption chargeable against pulp production of 13·3 kilowatts per ton fibre per 24 hours. This figure, however, should be reduced further, as the energy expended in grinding is not dissipated but is recovered as heat, the mixture of pulp and juice becoming heated in the grinding operation. Since the juice must be heated in any case, the heat absorbed by the juice represents useful work, so that the new power chargeable against board is only the energy lost in transforming the electrical energy through mechanical energy into heat plus the subsequent loss by radiation. Even without taking the saving in steam for heating into consideration, the figure of 13·3 kilowatts per ton of fibre per 24 hours compares very favourably with the 37 to 45 kilowatts per ton of pulp per 24 hours in grinding wood for similar grades of wall-board. Since the refining and beating costs are practically the same, these power consumptions in grinding form a good index for the comparison of cost in the use of wood and Vazcane pulp for board manufacture." The insulating board produced from Vazcane pulp is claimed to be equal to the best, and superior to most of the insulating boards on the market. In appearance the board is very uniform, with a fine mat surface. Strength equal to that of current boards is attained with a less dense board. The decreased density gives a board of decreased thermal conducductivity over current boards. The semi-commercial plant has proved so well the merit of the Vazcane process, that plans are under way for the erection of commercial-sized factories in several sugar-producing countries.

[The article illustrates: A cane grinder; a forming machine; a drying press; offices of the United Fruit Co., Havana, in which the Vazcane Insulation Board has been used for the interior finish; and lastly the Cabaret Tokio in which Vazcane semi-pressed board was used as interior finish.]

UTILIZATION OF MOLASSES (FOR ALCOHOL, GLYCERIN, AND ACETALDEHYDE PRODUCTION). **N. M. Rydlewski.** *Proceedings of the Third Annual Conference of the Association of Sugar Technologists of Cuba*, 1929.

During the European war, unable to obtain the necessary supplies for explosives, the Germans used the nitrogen from the air and the glycerin from the spent-wash of their distilleries, the latter according to processes which have been greatly improved since, now giving excellent industrial and financial results. Several shipments representing average Cuban molasses have been sent to Germany for practical trials employing those new processes, and gave the following yields (per cent. molasses): Glycerin, 29·38 (twice distilled); 94 per cent. alcohol, 23·52; and 75 per cent. acetaldehyde, 16·72 per cent., yields which are higher than at present obtainable from German beet molasses. Assume yields of only 24 per cent. of glycerin, equal to 2880 lbs. per 1000 galls. of molasses; and 14 per cent. of acetaldehyde, equal to 1680 lbs. per 1000 galls of molasses. Assume further that the distillery is making motor fuel composed of 60 galls. of alcohol and 40 galls. of sulphuric ether, then following is the commercial value of the various products that would be obtained in a distillery working from 50,000 galls. of Cuban molasses daily by modern methods: 18,162 galls. of motor fuel at 29 cents per gall. $5,266; 2050 lbs. of fusel oil, 10 cents

[1] West, *Paper Trade J.*, 1920, **19**, No. 21, 52.

per lb., $205 ; 4480 arrobas of compressed CO_2, $1 per arroba, $4480 ; 144,000 lbs. glycerin of 100 per cent., at 12 cents per lb. (18 cents in N.Y.) $17,280 ; and 84,000 lbs. of acetaldehyde of 75 per cent.) at 18 cents per lb. (25 cents in N.Y.), $15,120. That is a total of $42,351. Against this one sets the following manufacturing expenses : 18,162 galls. motor fuel (inc. tax), 35·4 cents per gall., $6,429 ; 2050 lbs. of fusel oil, without cost ; 4480 arrobas of CO_2 (dry ice), 25 cents per arroba, $1120 ; 144,000lb. of glycerin, at 8 cents per lb., $11,520 ; and 84,000 lbs. of acetaldehyde at 8 cents per lb., $6720 ; that is a total cost of $25,789. This gives a gross profit of $16,562, which, less 25 per cent. for amortization, taxes, insurance, administration charges, etc., leaves a nett profit of $12,421. Glycerin thus made would find a market all over the world without competition (the manufacturing cost of the product of soap manufacture being very much higher) ; while acetadehyde is used in large quantities in the paint industry, and is besides the principal base of many products. Carbon dioxide compressed to "dry ice" lasts ten times longer than water ice, is very hygienic and finds employment in many industries ; its loss by evaporation amounts to 10 per cent. per day. Hence the result of this study is that a distillery by working up 50,000 galls. of molasses, and producing glycerin and acetaldehyde in addition to alcohol motor fuel and the other by-products mentioned, can count on a daily nett income of $12,421 per day ; and the thought that occurs is the great possible value of the total molasses production of Cuba, amounting as it does to 250 million gallons per year.

History and Working of the Natal Ratio. **G. S. Moberley.** *Proceedings of the Annual General Meeting and Congress of the South African Sugar Technologists' Association*, 1929.

When sucrose payment for cane was inaugurated in Natal in 1927 the method of determining sucrose per cent. cane was laid down by the Fahey Conference Agreement, viz., the first crusher juice was tested for sucrose and this figure was multiplied by the Java ratio to give the sucrose per cent. cane. At first it was only considered practicable to determine the Java Ratio weekly, and a temporary figure had to be used daily. This was taken as the ratio of the previous week, though in some cases a fixed daily ratio was taken throughout the crop. The sucrose in cane thus determined was altered to the surface actually found in the cane at the end of the week by the application of a correcting factor. One variation of the above was tried. This was to multiply the sucrose per cent. crusher juice by the weight of cane for each consignment and from the sum of these figures, and the total weight of sucrose found in the cane, a ratio was established. This ratio was then multiplied by the product, sucrose per cent. crusher juice × tons of cane, which gave the adjusted sucrose in the individual consignments, without the application of a correcting factor. The advantage of this variation was that the ratio was based on sucrose in crusher juice as determined for the consignments, instead of on the sucrose in the four-hourly samples of crusher juice, and it also enabled these figures to be compared, and the accuracy of the testing thus checked. Before the 1927 season was very far advanced it became apparent that the Java Ratio method was open to a very serious objection whenever the cane was wet by rain. Water adhering to the surface of the cane was washed off by the juice and went almost entirely into the first crusher juice and lowered its brix. This, of course, raised the Java Ratio, but the increase of the latter was for a whole week, and applied equally to wet and dry days during that week. The position could not be met entirely by adopting a daily Java Ratio, as it often happened that cane was wet for only part of a day. The result was that the sucrose per cent. cane for dry cane was too high at the expense of the wet cane. It therefore became necessary to find some means of overcoming this difficulty, and a committee of millers' and planters' chemists was convened to study the problem.

From a series of experiments initiated by the writer at some of the larger factories, it became apparent that while wet cane caused a drop in Brix at the first crusher, the brix at subsequent units was scarcely affected. It was therefore

suggested that the ratio should be based on the first mill juice (or what was subsequently termed the last pre-maceration juice), instead of on the first crusher juice. However, it was still necessary to test the first crusher juice for purity in order to apply the Fahey scale of purity bonus and penalty. As the testing of both juices for sucrose would have involved a lot of extra work, it was suggested that the ratio should be based on the product, brix of last pre-maceration juice × purity on first crusher juice. This product was named the Natal Sucrose, and the ratio based on it was named the Natal Ratio, viz.: $\frac{\text{Sucrose per cent. Cane}}{\text{Natal Sucrose}} \times 100$ which was adopted in the amendment to the Fahey Conference Agreement, known as Schedule B. The Natal Ratio has been in operation for a whole season, but it has been difficult to judge the effect of it owing to the fact that 1928 was an exceptionally dry year. The author has studied the figures at the four largest factories, and finds some extraordinarily conflicting results. In some cases the Brix of the L.P.M. juice remained steady during the wet weather, and in other cases it dropped, and there were even cases where it rose. However, while the use of the Natal Ratio appears to have been fairly satisfactory, it has not had a fair trial owing to the very dry conditions last year, and it should be continued for another year, when its further continuance can again be discussed, unless it is then possible to supersede it by a ratio based on the fibre per cent. cane.

Industrial Alcohol. **Warren N. Watson.** *Chem. & Metall. Eng.*, 1930, **27**, No. 3, 160-161. One bushel of corn yields about 2·4 wine gallons of alcohol, and 2·7 gallons of blackstrap about 1 wine gallon, 1 bushel of corn thus being equivalent to nearly 6½ gallons of molasses. Cost of alcohol production from corn (at 84 to 94 cents per bushel) allowing for the value of the spent grains is 37 to 40 cents per wine gallon, and that from molasses at 6·5 to 9·5 cents per gallon is 25 to 33 cents per wine gallon. This for average sized plants. "The most convincing argument against the investment of capital in new grain alcohol plants in the West is the advent of synthetic ethyl alcohol, which has already developed on a commercial scale in Europe . . . . Its cost of production in England was reported in 1922 at about 30 cents per gallon." Another factor in the alcohol situation is the question of substitution of other products, keen competition being now encountered from glycerin and ethylene glycol as anti-freeze preparation, which is at present the principal use to which denatured alcohol is put in the U.S.A., 40 million out of a total production of 90 million gallons being used for that purpose.—Catalytic Properties of Decolorizing Carbons. **G. Mezzadroli and E. Vareton.** *Zymologia*, 1929, 4, Nos. 5 and 6, 170-175; through *Deut. Zuckerind.*, 1930, **55**, No. 16, 423. Following are shown the c.c. of oxygen evolved at 17°C. from 5 c.c. of 3·6 per cent. hydrogen peroxide diluted with 10 c.c. of water in 30 min. by 2 grms. of various carbons; Charcoal, 14·6; Carboraffin, 3·2; Antichromos, 7·0; Nuchar-W, 14·8; Suchar-W, 24·4; standard Norit, 28·4; Supernorit, neutral, 40·4; Supernorit, acid, 44·2; Appula, 56·6; and bonechar, 53·0. After complete exhaustion of the decolorizing power of these carbons, their catalytic power equalizes, those which before had a high d.p. become less active, and vice versa.—Dilution in Relation to Comparative Purities. **Hayward H. Hill.** *Facts about Sugar*, 1930, **25**, No. 23, 568-571. In sugar factory products the difference between the total solids determined by the Brix hydrometer and the true total solids present becomes greater as the concentration at which spindling is done decreases. An essential, therefore, to be observed by the chemist in spindling is that the total solids of each product should differ from the true solids as nearly as possible by the same amount as the difference present in the case of the juice. Experiments lead the author to conclude that in order that the syrup purity be comparable with that of the juice from which it is obtained it must be diluted previous to spindling to approximately the same density and non-sugar concentration as the juice. In the case of final molasses, diluting it 1 to 1 will give a purity more nearly comparable than if diluted to a greater degree, for instance to the density of the juice. Syrup must be diluted to approximately the same density and non-sugar concentration as the juice.

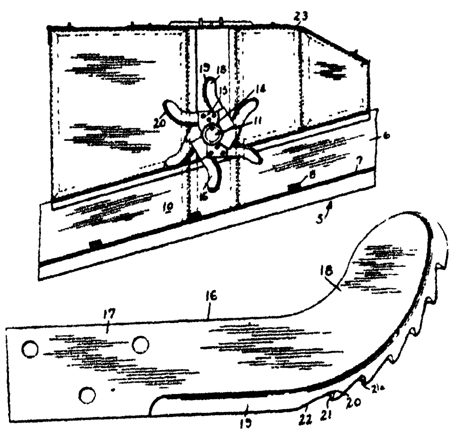
J. P. O.

Review of Recent Patents.[1]

UNITED STATES.

CANE MILL KNIVES. Norman Kay, of Jobos, Porto Rico. 1,758,445 ; serial 222,896. Patented, May 13th, 1930 ; application filed, September 29th, 1927.

Mill knives used heretofore have been provided with smooth cutting edges which are intended to slice into the cane and cut it into fragments. This arrangement of knives is apt to strike the cane stalks with glancing blows. The present invention contemplates a knife which preliminarily shreds the cane to a very considerable degree, thereby materially reducing the work to be done by the rolls, so that in many cases their number can be reduced to advantage. A knife having a cutting edge is thus provided with a series of serrations or notches adapted to hook into the cane and shred it, in addition to the ordinary cutting and chopping action. Numeral 5 indicates a part of a conveyor 6, provided with an endless belt 7, having slats 8, adapted to conduct cane to a preliminary crusher (not shown). Conveyor 6 is provided with side walls 10, to prevent the escape of cane. Above the side walls 10 is a rotary shaft 11, mounted in bearings 12 and 13, supported in any suitable manner on the mill 5. Secured on the shaft 11 between the side walls 10 of the conveyor 6 is a series of spiders 14, provided with arms 15, each arm having secured thereon, by suitable means, a cane knife 16. Each of the cane knives 16 comprises a shank 17, tangentially arranged on an arm 15, and a blade 18, curbed or bent back from the direction of movement of the knife, and provided with a cutting edge 19, which is interrupted by notches or serrations 20, each notch or serration having a cane engaging face 21, substantially at right angles or normal to the cutting edge of the blade, and another face 22 extending towards the shank and intersecting the cutting edge of the blade at an acute angle. The edges of the faces 21 are bevelled as at 21^a to provide relatively sharp cutting edges.



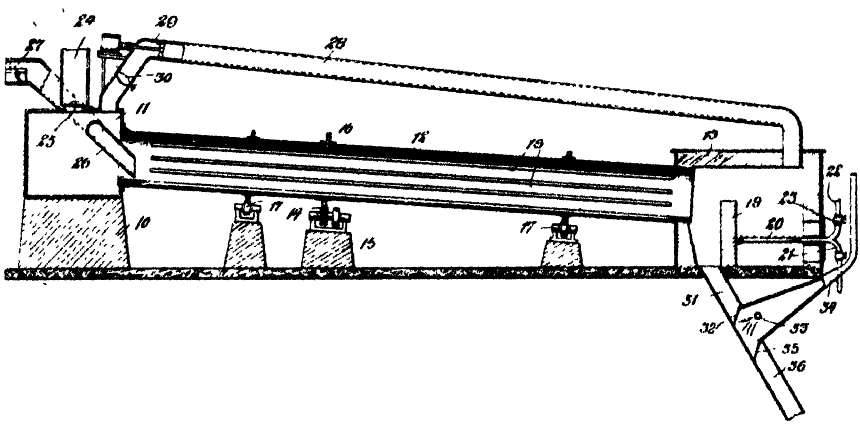
In operation, cane is carried by the conveyor belt 7, and the slats 8 thereon, to the preliminary crusher 1, passing under the rotary knives 16, which extend into the conveyor to a point closely adjacent the slats 8 of the belt 7, and are rotated at a relatively high speed. The cutting edges 19 of the blade 16 engage the cane to cut it up into pieces, the teeth formed by the notches 20 of the blades hooking into the cane and tearing it and shredding it, in addition to the normal cutting and chopping action of the blade. The notches provide in each revolving blade or arm a plurality of claws, spaced apart longitudinally of the arm, which repeatedly engage and tear apart the stalk portions. The rotating knives 16 are so arranged in the conveyor 7 as to cut into the blanket of the cane to quite a depth, in order that substantially all of the blanket may be acted on and shredded by the knives. In practice, the improved knife has shredded to a quite complete and satisfactory degree the entire body or mass of cane moving toward the mill on the conveyor. This is ascribed to the serration of the knife blades, and more particularly to the fact that the blades are provided with a plurality of transverse cane shredding edges

[1] Copies of specifications of patents with their drawings can be obtained on application to the following—*United Kingdom* : Patent Office, Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2 (price 1s. each). Abstracts of United Kingdom patents marked in our Review with a star (*) are reproduced from the *Illustrated Official Journal (Patents)*, with the permission of the Controller of H.M. Stationery Office, London. Sometimes only the drawing or drawings are so reproduced. *United States* : Commissioner of Patents, Washington, D.C. (price 10 cents each). *France* : L'Imprimerie Nationale, 87, rue Vieille, du Temple, Paris. *Germany* : Patentamt, Berlin, Germany.

located at the edge of the blade in planes which are approximately normal to the plane of the blade itself. These shredding edges grip, bite into, and tear apart the cane stalks, which lie upon the conveyor in a dense mass so as to offer effective resistance and prevent displacement of the stalks away from the rearwardly bent or curved tips of the blades.

Reactivating Bonechar. **Edgar W. Rice,** of Yonkers, New York. 1,758,202. May 13th, 1930.

In the present invention, the kiln is internally fired, and the gases are recirculated, effecting a considerable saving in fuel; also the process is carried out at a rather low temperature and the char in its passage through the kiln encounters sufficient air to support actual conbustion. Thus the organic matter is actually burned out of the char rather than distilled off, no carbon deposits are formed, and the treated char is thoroughly reactivated and entirely free from clogging carbon deposits on its surface. In the accompanying drawing 10 designates a suitable base upon which an inlet chamber 11 is supported. An inclined rotary kiln 12 of conventional construction has bearings at its upper end in the walls of the inlet chamber 11, and at its lower end in one wall of a fire-box 13. Mechanism for rotating the kiln has been illustrated as a driven pinion 14 supported upon a base 15 and meshing with a ring



gear 16 fixed to the kiln. It is provided with the usual number of longitudinally extending flights 18 for thoroughly tumbling and agitating the char as the latter is passed through the kiln. A vertical baffle wall 19 in the fire-box protects the discharge end of the kiln from receiving directly radiated heat from the burner 20 (either gas or oil). From the chamber 11 there rises a flue 24 preferably equipped with an automatic damper 25 which is controlled by the pressure in chamber 11. The char or other material to be treated is delivered through a chute 26 to the upper inlet end of the kiln, and may be brought to the chute by a screw conveyor 27, or other suitable mechanism. An air recirculation pipe 28 extends from the upper end of chamber 11 back to the fire-box 13. A suitable fan or blower 29 in the pipe maintains a positive recirculation of gases back to the fire-box, and the pipe may be controlled by a damper 30 introduced between the chamber 11 and the fan. The heated char discharging from the lower outlet end of the kiln, drops into a chute 31, and passing under a gate valve 32, is subjected to a cooling spray of water from any number of spray heads 33 mounted in steam escape pipes 34.

Char to be reactivated is discharged through the chute 26 into the upper end of the kiln, usually in a rather moist condition. The air supply is so regulated that the hot gases and products of combustion passing through the kiln from the fire-box will actually support combustion of the organic matter which has been adsorbed by the char. Due to the presence of blower 29 and damper 25, there will be a recirculation of gases back through the recirculation pipe 28 to the fire-box. The damper 25, of course, automatically opens to relieve pressures in the recirculation system,

and when recirculation is undesirable, it will be a very easy matter, not only to stop the recirculation by closing damper 30, but to quickly cool the kiln by the action of fan 29. The temperature in the kiln is maintained approximately between 400 and 800° Fahr. The char in its passage through the kiln is agitated and tumbled by the flights 18, so that by the time it has reached the discharge end of the kiln, the entire surface of the mass of material will have been properly exposed to the air and reactivated by the burning out of the organic matter as above described. The hot char coming down the chute 31 and under the gate valve 32 is properly cooled by the water spray at 33, and passes at a relatively low temperature through chute 36 to the storage bin or other receptacle. By recirculating the gases a considerable economy of fuel may be effected and a substantially uniform temperature maintained throughout the entire length of the kiln.

MANUFACTURE OF ABSOLUTE ALCOHOL. **Eloi Ricard,** of Melle, France (assignor to **U. S. Industrial Alcohol Co.,** of New York). 1,744,503; and 1,744,504; serials Nos. 688,049 and 724,132. Applications filed, January 23rd, 1924, and July 2nd, 1924; both patented January 21st, 1930.

It is known that when there is added to the commercial alcohol to be dehydrated, an entraining body capable of forming a ternary azeotropic mixture and when this mixture is distilled, the vapours resulting from the distillation will contain the three components of the azeotropic mixture in a constant ratio irrespective of the quantities of the bodies in the reaction which were originally placed in the distilling column. In these conditions, the water can be entirely withdrawn from the mixture, and the column then contains only a binary mixture consisting of absolute alcohol and the entraining body, which mixture is separated by continuing the distillation so that absolute alcohol is finally obtained at the bottom of the column. It has further been proposed to treat the vapours of the azeotropic mixture which are discharged from the distilling column, and to produce, after condensation, either a homogeneous liquid or a liquid which separates into two layers, in order to recover the entraining body and the absolute alcohol contained in the homogeneous liquid or in the liquid consisting of two layers. The second invention relates to an improvement in the first described in application Serial No. 688,049, filed January 23, 1924, which consists in the utilization as the entraining liquid of a mixture of liquids which are suitably selected for the purpose, so as to take advantage of the favourable properties of one or more of the said liquids and to eliminate their unfavourable properties, so that on the whole the operation may be carried out with greater facility, or the output of the same may be increased. The said application discloses in general a process for producing absolute alcohol from aqueous alcohol by the addition of an entraining liquid, such, for example, as a petroleum hydrocarbon, the distillation being carried out therewith so as to obtain a condensate which separates into liquid layers, the layer containing the high percentage of entraining liquid being returned to the still, while the layer containing the high percentage of water is first subject to the action of a dehydrating substance and then returned to the still. In the three examples given in the first application, the withdrawing body consisted of butyl chloride, carbon tetrachloride, or ethyl acetate.

This present invention is an improvement over that described in connexion with the serial mentioned, and benzene, ethyl acetate or gasoline may be used as entraining liquids. Benzene when used alone as the entraining body will produce a ternary mixture having the minimum boiling point (about 65°C.) and which separates by condensation into two layers. The bottom layer, which contains the major part of the water in the mixture, represents 16 per cent. of the total volume and contains some 32 per cent. of water, thus affording, per 100 volumes of distillate, a withdrawal of 5·12 volumes of water. The upper layer would have the following composition by volume; benzene 85 per cent., alcohol 13 per cent. and water 2 per cent. Gasoline which is well rectified so as to be entirely distilled between 100-101°C. will produce a ternary mixture having the minimum boiling point (70°C.) which separates by condensation into two layers. The bottom layer, which contains nearly all the water in

the mixture, represents 37 per cent. of the total volume and contains 18 per cent. of water, affording per 100 volumes of distillate a withdrawal of 6·6 volumes of water. The composition by volume of the upper layer, in this instance, would be as follows: gasoline 96 per cent., alcohol 3·5 per cent. and water 0·5 per cent. From the preceding it will be observed that aside from the advantages offered by the latent heat of vaporization and the specific heat, gasoline is more favourable than benzene as concerns the power of withdrawal of the water, but the decantation of its ternary mixture is less advantageous, since for equal amounts of water withdrawn, the volume of the bottom layer to be treated will become nearly twice that of the water in the case of benzene. Claim is made for: "A process for the manufacture of absolute alcohol from aqueous alcohol, comprising the mixing together of aqueous alcohol, benzene and gasoline, present in sufficient quantity to remove substantially all the water from the alcohol, and the benzene and gasoline serving as entraining bodies to form with the alcohol an azeotropic mixture containing water when distilled having a minimum boiling point, and in which the said mixture is subjected to distillation in such manner as to obtain absolute alcohol as a residue, the said gasoline having been distilled between 100 and 102°C."

Washing Tricalcium Saccharate. **Carl Steffen, Jr.**, of Vienna. 1,757,979. May 13th, 1930. The process of continuously treating liquor carrying precipitated calcium saccharate comprises adding directly in the precipitation apparatus itself in successive stages a washing solution, the successive washes carrying a decreasing non-sugar content.—Propagating Sugar Beets. **Wm. B. Rosevear**, of Toledo, Ohio. 1,758,128. May 13th, 1930. The process of raising tap-root seedlings, comprising planting the seed in an above-ground earth-filled bed, and washing the earth from the roots while in the bed when the seedlings have grown sufficiently for transplanting.—Cane Milling Apparatus. **Norman Kay**, of Jobos, P.R. 1,758,445. May 13th, 1930. In a cane mill, means for feeding cane, and means for engaging and shredding the cane while being fed, said last named means comprising a rotary shaft, a series of cutting knife blades carried on said shaft and extending outwardly therefrom, and clawlike means formed on said blades adapted to hook into and shred cane. —Automatically Controlling Centrifugals. **Eugene Roberts** (assignor to **The Western States Machine Co.**, of Salt Lake City, Utah). 1,758,901. May 13th, 1930. In a centrifugal apparatus, the combination with a centrifugal machine and its driving means, of means for starting the centrifugal through its driving connexion, a brake and an automatically timed sprayer co-operatively associated with the centrifugal, and co-ordinated timing means acting to start the operation of the sprayer at a pre-determined interval after the centrifugal is started and to apply the brake at a pre-determined interval after the spraying operation has ceased.—Evaporator. **Russell C. Jones** (assignor to the **Griscom-Russell Co.**, of New York). 1,760,907. June 3rd, 1930. An evaporator comprises a shell, heating tubes within said shell, distributing means positioned above said heating tubes and substantially co-extensive therewith for distributing the incoming liquid above the heating tubes and passing it down upon said tubes, whereby the liquid will cover the tube surfaces in a thin film, rigidly spaced tube sheets wherein the ends of the heating tubes are fixedly supported, said tubes having a curvature which varies in magnitude with changes in temperature and thereby flexes the tube surfaces causing exfoliation of accumulated scale, and means for recirculating the liquid which passes the heating tubes unevaporated.—Absolute Alcohol. **Russell B. Crowell** (assignor to **American Solvents and Chemical Corporation**, of New York). 1,761,779. June 3rd, 1930. (1) In a batch process of manufacturing anhydrous alcohol from aqueous alcohol, the step of forming a mixture of aqueous alcohol and a liquid substance capable of forming an azeotropic ternary mixture with alcohol and water, the said substance being present in an amount not exceeding that required to form said ternary mixture, distilling said mixture to separate an azeotropic mixture of alcohol, water and said substance therefrom and maintaining sufficient said third substance in the batch mixture during the distillation to completely dehydrate the alcohol.—

CANE CUTTING AND DELIVERY MECHANISM. **Horace Johnson and William A. Ramsay,** of Honolulu, T.H. 1,761,987. June 3rd, 1930. Claim is made for the combination with a rotary cane cutter and a cane delivery mechanism of means for co-operating with the cutter to prevent the cutter from throwing the cane, before properly cutting up the same into the delivery mechanism and for assisting in cutting up the cane, the latter means including a plurality of spaced bars arranged upon an arc of a circle, the centre of which is substantially the axis of the cutter.—ALCOHOL PRODUCTION. **Frank E. Lichtenthaeler,** of Newton Highlands, Mass. 1,759,122. May 20th, 1930. Claim is made for the step in the method of making alcohol by fermentation and distillation, wherein water substances enter the process, and wherein alcohol-vapour-air-gas mixture products are evolved, which consists in scrubbing the alcohol-air-gas-mixture products by the water substances to recover the otherwise wasted alcohol from the alcohol-vapour-air-gas mixture.—MILL SHREDDER. **Franklin Farrel, Jr.** (assignor **Farrel-Birmingham Co., Inc.,** of Ansonia, Conn., U.S.A.). 1,759,896. May 27th, 1930. A cane mill comprises shredding means, means co-operating therewith adapted to support cane passing through said mill while acted on by said shredding means, and means for resisting movement of the cane over said co-operating means due to the action of said shredding means thereon. said last named means being provided with a cane supporting surface arranged at an angle to the adjacent cane supporting surface of the co-operating means.—REFRACTOMETER. **Franklin Pfeiffer** (assignor to **Carl Zeiss,** of Jena, Germany). 1,760,209. May 27th, 1930. This invention comprises a refractometer for determining a property of a liquid upon which depends the refractive index of this liquid, containing a prism system with a surface adapted to totally reflect rays which have entered the prism, a telescope so disposed behind the prism systems to be capable of receiving rays passed through the said prism, a reading device comprising a scale and a diagram, which diagram consists of a number of curves, both said parts being displaceable relatively to each other, each of the said curves representing the relation of the said property and the temperature, and the scale indicating one of these two quantities, and each of the said curves pertaining to a certain definite degree of the quantity not indicated on the scale, a mark fixed within said telescope, a deflecting device located behind the said prism system and adapted to adjust the position of the extreme rays which are yet totally reflected at the said surface relatively to the said mark, and means for coupling the reading device and the deflecting device.—LEVULOSE PRODUCTION. **Wm. C. Arsem,** of Schenectady, N.Y. 1,763,080. June 10th, 1930. Inulin is hydrolysed to form levulose by mixing with it the theoretical quantity of water necessary to hydrolyse it, adding a soluble acid anhydride, and heating in a closed container.

UNITED KINGDOM.

PRODUCTION, APPLICATION, AND REVIVIFICATION OF ACTIVATED (DECOLORIZING) CARBON. (*A*) **E. Berl,** of Darmstadt, Germany. 324,729; addition to 283,968. November 7th, 1928. (*B*) **T. A. Goskar,** of Brent Knoll, Somerset. 329,630. February 19th, 1929.

(*A*) The process for making activated carbon according to the parent specification[1] is modified by adding, to the mixture of acid tars and potassium compounds, carboniferous substances of another kind which can be activated, such as natural or carbonized wood, peat, brown coal, or other substance containing cellulose. Substances containing organically combined potassium, such as potassium phenolate, naphtholate or alizarin may also be added. To the acid tar may be added half its weight of water, in order to dissolve some of the sulphuric acid. The pitch-like mass separated and treated with potassium chloride and then with potassium carbonate, hydroxide or sulphide, before or after the addition of 5 to 100 per cent. of the carboniferous substance and with or without a small proportion of water. The mass may be moulded into rings and is then dried and heated to 900-1100°C. The potassium compounds may be partly replaced by sodium compounds. (*B*) In the manufacture

[1] *I.S.J.*, 1928, 220.

of activated carbon, non-distilled carbonaceous material such as peat is formed into pellets, e.g., by means of a pugging mill, charged into a vertical or inclined chamber, dried by forcing hot air or gases therethrough, subjected to dry distillation by direct contact with gases from the subsequent activating stage and activated by heat and gases.

CONFECTIONERY. (*A*) **C. B. K. Boggild and M. Jacobsen**, of Copenhagen, Denmark. 325,245. November 8th, 1928. (*B*) **K. A. M. Reiche**, of Dresden, Germany. 325,389 February 14th, 1929. (*C*) **C. A. and G. Cofman-Nicoresti**, of Ealing, London. 326,447. December 10th, 1928. (*D*) **S. S. Savage**, of Rochester, N.Y. 327,115. November 26th, 1928. (*E*) **Lyons & Co., Ltd., and D. A. Granville.** 328,318. January 21st, 1929. (*F*) **B. Muller**, of Neukolln, Germany. 329,015. February 8th, 1929. (*G*) **S. Cooper**, of Brooklyn, New York. 329,183. May 29th, 1929.

(*A*) In chocolate, etc., casting machines wherein the material is drawn from a hopper into measuring cylinders and is subsequently delivered through outlets by an oscillatory valve member, the member is interchangeable to vary the number of delivery outlets in accordance with the number of moulds and also to correlate each delivery outlet with one or more measuring-cylinders. (*B*) Apparatus for feeding chocolate into moulds comprises a piston chamber, having a perforated bottom, which chamber is supplied with material from a hopper by an auxiliary pump, the perforations being closed by a perforated slide during filling of the chamber and opened for delivery of the material by the piston. (*C*) Alcohol, strong alcoholic beverages, tinctures and the like are jellified by boiling with pectin with or without the addition of dextrose, organic acids, gums, or flavouring or colouring matter, and casting into shapes, tablets, or lozenges. Examples are given in which (1) alcohol is heated with pectin, gum tragacanth and gum arabic ; (2) tincture of orange and essence of cognac are boiled with pectin containing a small amount of organic acid such as citric acid. (*D*) Apparatus for moulding plastic materials which tend to crystallize if agitated, e.g., candy, comprises means for continuously feeding material under fluid pressure and without agitation to a series of moving moulds formed in heat-absorbing material. The material is contained in a jacketed hopper comprising a pair of chambers to which the fluid pressure is applied alternately. (*E*) In the preparation of sweetmeats by the crystallization of solutions or plastic substances, e.g. the manufacture of cream fondant from a boiled solution of cane sugar and invert sugar or glucose, a fine uniform texture is obtained by passing the solution or plastic substance between one or more pairs of rollers, one roller of each pair rotating at a different peripheral speed from the other. The substance treated may be in a heated condition, and the rollers may be cooled. The substance may pass upwards from the lowest pair of rollers to the highest. (*F*) A process for the preparation of cocoa beans after the alcoholic fermentation comprises subjecting the beans to a heating process in a stagnated atmosphere in a closed room at a temperature not exceeding 50°C., to produce a swelling of the beans and a loosening of the tissues, the beans being then subjected to a drying process in the same room by a stream of dry air at a temperature not exceeding 60°C. whereby the internal moisture of the beans is expelled. (*G*) Coconut, etc. confections of a fluffy texture and an irregular contour are produced by forcing the material through dies having an irregular contour and nicking the extruded streams to form a series of conical protusions.

DRYING OF BEET SLICES. **Arcos, Limited (I. Tischtschenko and V. Tchefranoff,** both of Moscow). 329,112. April 11th, 1929. Raw sugar beet slices are given a preliminary treatment with pulverized or dissolved alkali such as cautic alkali or carbonates of metals of the first or second group to neutralize the acids contained in the cellular juice and also to neutralize the free acids contained in the gases used for subsequent drying in the drying chamber. The juice obtained from such slices is more easily purified.

United States.

(*Willett & Gray.*)

(Total of 2,240 lbs.)	1930. Tons.		1929. Tons.
Total Receipts, Jan. 1st to July 26th	1,482,042	..	2,311,922
Deliveries „ „	1,762,151	..	2,016,111
Meltings by Refiners „ „	1,743,420	..	1,829,791
Exports of Refined „ „	25,500	..	58,000
Importers' Stocks, July 26th	157,162	..	394,042
Total Stocks, July 26th	335,487	..	645,086
	1929.		1928.
Total Consumption for twelve months	5,810,980	..	5,542,636

Cuba.

STATEMENT OF EXPORTS AND STOCKS OF SUGAR, AT JUNE 30TH.

(Tons of 2,240 lbs.)	1928. Tons.		1929. Tons.		1930. Tons.
Exports	1,846,529	..	2,825,662	..	1,203,419
Stocks	1,157,428	..	1,298,387	..	1,631,332
	3,003,957	..	4,124,049	..	2,834,751
Local Consumption..	49,119	..	42,223	..	32,476
Receipts at Ports to June 30th ..	3,053,076	..	4,166,272	..	2,867,227

Habana, June 30th, 1930.

J. GUMA.—L. MEJER

Sugar Crops of the World.

(*Willett & Gray's Estimates to July 3rd*, 1930.)

	1929-30. Tons.		1928-29. Tons.		1927-28. Tons.
CANE.					
America	8,850,462	....	9,190,564	....	8,147,901
Asia	7,341,375	....	7,318,783	....	6,891,715
Australasia	618,163	....	633,066	....	588,163
Africa	717,658	....	737,562	....	656,360
Europe	10,000	....	11,610	....	10,552
Total Cane	17,537,658	....	17,891,585	....	16,294,691
BEET.					
Europe	8,299,762	....	8,420,818	....	8,031,874
U.S.A.	901,713	....	938,640	....	965,241
Canada..............	27,869	....	28,857	....	27,212
Total Beet	9,229,344	....	9,388,315	....	9,024,327
TOTAL CANE AND BEET....	26,767,002		27,279,900		25,319,018

United Kingdom Monthly Sugar Report.

Our last report was dated 9th July, 1930.

The general depression continues to prevail and little interest is shown by refiners and manufacturers. Buying is still confined to fulfilling immediate requirements and speculative purchases are for the present non-existent.

Rumours continue to be circulated as to the discussion in Cuba of certain steps being taken with a view to establishing better prices, and prices have fluctuated slightly accordingly as these rumours appear to have any foundation of fact.

The Terminal Markets of London have fallen away still further during the month and about 20,000 tons was tendered against August delivery. The general tone of the market is irregular and the present prices are :—

	AUGUST	DECEMBER	MARCH	MAY
Raw	4s. 11½d.	5s. 2¼d.	6s. 3d.	6s. 6d.
White	8s. 3d.	8s. 3d.	—	—

The New York futures market also registers a decline over the month of 8 to 12 points. The British Refiners have not followed the decline and their prices remain unchanged.

Business in Raws has been inactive at the decline, the present price being about 5s. 9d. nominal.

In Cuba the stock is accumulating and the amount at the ports on August 2nd was 1,418,000 tons compared with 979,000 tons at the same time last year. Visible supplies from Statistical countries show an increase of more than 1,000,000 tons over last year.

F. O. Licht reports no change in his estimate of the European crops, but states that warm weather is wanted. The weights show a satisfactory increase but the sugar contents of the roots have not made such a good progress as was anticipated.

Arthur B. Hodge,
Sugar Merchants and Brokers.

21, Mincing Lane,
London, E.C.3.
8th August, 1930.

THE

INTERNATIONAL SUGAR JOURNAL.

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☞ The Editors are not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

The Editors will be glad to consider any MSS. sent to them for insertion in this Journal, and will endeavour to return the same if unsuitable; but they cannot undertake to be responsible for them unless a stamped addressed envelope is enclosed.

No. 381. SEPTEMBER, 1930. VOL. XXXII.

Notes and Comments.

The Outlook.

With the failure this summer of Dr. GUTIERREZ (President MACHADO'S chief Cuban negotiator) to get any feasible proposals accepted by Java and the European countries for an international agreement of sugar restriction, it might well have been thought that an impasse had been reached. But the stage has been shifted to America, for it seems that the Canadian and American banking interests who by their aloofness last Spring did much to allow the "Single Seller" arrangement to fall through, have now changed their attitude and are apparently more willing to confer with Cuba's representatives on ways and means for overcoming the present crisis. These Cuban-American producing and banking interests arranged a conference in New York on August 26th, at which were represented the sugar industries of Cuba, U.S. Domestic, Louisiana, Porto Rico, and the Philippines. No final agreement was reached, but it would appear that certain proposals of Cuba received close attention and will be further investigated by a committee. The Cuban main proposal is that Cuba's sugar exports for five years from 1931 to the U.S.A. should be limited to 2,800,000 tons per annum, and that one million tons, from either the present or the next crop, should be annually segregated for marketing to countries outside the U.S. This arrangement is to last for five years, but is to be contingent on U.S. Domestic Beet and Insular Possessions producers agreeing to limit their crops for those years to the tonnage produced by them during 1930, any increase in the consumption in the U.S.A. during the first three years being supplied by Cuba, Cuba also supplying half of the increase in consumption during the last two years and Domestic and Insular producers the remaining half. Cuba also agrees to endeavour to bring along an international conference with the object of a world-wide stabilization of the sugar markets.

The conference was continued, but at the time of writing a fortnight later no further information has been elicited. It is obvious that these new proposals deserve very serious consideration, and even if the other parties to the negotiations feel reluctant to concede anything, they must realize they are all in the same boat, struggling against the incubus of low prices, and knowing that they cannot sit still and do nothing and yet expect any amelioration of

their position. It has been said that Java's reluctance to accept restriction with Cuba is due to the suspicion that it would merely leave other American producers free to extend their production. If then these New York negotiations (probably destined to be known as the Chadbourne Conference) bring the American producers under some bond of agreement to practise restriction, one of Java's principal objections to joining with Cuba will be eliminated. We hope that the banking interests who have so considerable a stake to lose in Cuba will be more successful in formulating a workable scheme than have the politicians who for various reasons work too frequently at a disadvantage. In this connexion, we would refer to some suggestions on another page on the part of our Cuban correspondent, urging the banking community to make the most of the possibilities of the situation.

Another Cuban proposal which may help to reconcile the objectors to the compromise is the resurrection of the so-called Claret plan, first propounded by Dr. SANTIAGO CLARET in 1927. The idea is that the Cuban Government should institute an export tax on all Cuban sugar shipped to the States, to the amount of say 40 out of the 50 points preference allowed Cuban sugar by the new American tariff. It is argued that if Cuban exports to the States are restricted to under three million tons annually and other producers keep to their agreed limits, then the Cuban seller should have little difficulty in getting the 40 points in his price to the American buyer and reimbursing himself for the loss in paying the export tax. The proceeds of this tax would be distributed to the Cuban sugar industry by the Government as some form of bonus on export of sugar to other destinations where lower prices have to rule. The feature of the plan according to its promoters is that it suppresses the intervention of the human factor in the course of sales to the U.S. and ensures in theory, at any rate, that the Cuban seller will have a better chance of passing on the 40 points tax to the American buyer—otherwise in getting 40 points of the Cuban preference, which under present conditions he certainly does not. If Cuba gains her duty preference, the other producers for the American market stand to gain pro rata, hence the Chadbourne-Claret scheme has some strong points in its favour in the matter of reconciling the objections and lulling the suspicions of the competing parties. But the winning over of the American Domestic producing interests will not be an easy nut to crack, and the American Sugar Cane League, speaking for Louisiana, is reported at the outset to be opposed to any concession. But unless producers in general are blind to their ultimate interests, they cannot view with complacence the continuation of present-day prices; their present output if it could be sold at 50 or more per cent. increase in price would be more remunerative than a somewhat larger crop at present bankrupt prices.

Crop Estimates.

Meanwhile if cane sugar producers are everywhere content to mark time in the matter of output, the latest figures of the European beet sugar industry show an unwelcome advance, due in the main to the fact that Russia is carrying on a scheme of vast expansion of her beet industry destined to be completed within five years. F. O. LICHT issued no fresh estimates at the end of August; but Dr. MIKUSCH has published figures which show a reduction as compared with his April estimate in respect to Europe without Russia, but increase the Russian quota, so that the estimated total for all Europe remains in the neighbourhood of 2,950,000 hectares (as against 2,635,000 in 1929) and 9,784,000 metric tons sugar, raw value, (as compared with 8,220,000 in

1929). Russia's area is increased from 784,000 hectares (actual) to 1,044,000 (estimate); and the sugar tonnage from 921,000 (raw value) to 2,200,000 tons. Thus Europe without Russia promises 3·03 per cent. increase in area and 3·90 per cent. increase in tonnage of sugar; with Russia, the figures are respectively 11·99 and 19·03 per cent.

In the ordinary course these figures would be disturbing; but the market finds so much of a contradictory nature in Russian operations that doubts are expressed whether the official figures of Russian production are at all likely to be achieved. Russia has been buying Cuban sugar rather freely of late, and rumours of some substance have credited her with the intention of importing further large amounts, up to even one million tons by the middle of 1931. It is said that the Cuban authorities think well enough of the possibility to be sending a mission to Russia to negotiate further sales. But is the sugar really wanted, it is asked? Russia's pre-war consumption (about 27 lbs. per head) was somewhat under two million tons, so that the 1930-31 Russian beet crop would yield a surplus on the basis of those figures. If the Soviet State has the intention (not yet disclosed) of increasing the internal consumption, there is ample scope for expansion. Mr. GOLODETZ reckons that a 100 lbs. per capita consumption would need between six and seven million tons of sugar, which statement shows the immense potentialities of a prosperous Russia. But Russia is also credited with the desire to develop an export market in several commodities as a means of lightening her financial stringency. So the market will not be unprepared for an attempt to export Russian surplus sugar at low prices. But it is to be hoped that the sounder economic policy of increasing internal consumption has a basis in fact, in which case the present imports may be a necessary factor in helping to develop the increased demand.

The Dutch Attitude.

The annual report of the General Syndicate of Sugar Manufacturers in the Dutch East Indies which was issued last month views the position of the world sugar industry as considerably more unfavourable than even during the crisis of 1920-21. The low cost of production in Java is being largely neutralized by the policy of protection; still the industry has not as yet been forced to a reduction in labour or a cut in wages or to restriction of production, thanks to its large reserves and its persistent policy of rationalization. It is pointed out that about half the world's population—that in China, India and Russia—is at present living under extraordinarily restless political conditions which have an inevitable economic repercussion affecting the normal capacity for consumption. Yet these countries must at some future time prove again enormous markets for sugar. It is admitted, however, that should the present slump continue or even get worse, and no reaction develop in the advance of protection, the situation in Java might call for special provisions.

According to the *Financial Times*, the opinion in Dutch sugar circles with regard to the Cuban proposals of restriction and an international conference and co-operation between Java and Cuba is much divided. Still, the majority continues to be decidedly averse to any co-operation with Cuba, principally because of the sugar crisis. Co-operation between Java and Cuba would, in any case, have hardly any good effect, because the possible increase of the market price would necessarily lead to a sharp increase of production on the part of other sugar producing countries. The market price is not altogether regulated by Cuba and Java. To entertain high expectations at the moment with regard to a Cuba-Java understanding would therefore be unwise. Still,

if it comes to a policy of "survival of the fittest," which is the true attitude of the Java producers, it is pointed out, not without reason, that though Java occupies the strongest place among the world producers, Cuba is supported by American bankers. In the Cuban sugar plantations not less than $900,000,000 of American capital have been invested.

World Botanists in Conference.

The botanists of the world have just held their fifth meeting, at Cambridge during the week, August the 16th to the 23rd. This Congress meets every five years, and this is the first time that it has met within the British Empire, previous meetings having been in Paris, Vienna, Brussels and Ithaca, U.S. While of course many countries are not yet represented, over fifty sent delegates from Government and other Institutions and learned Societies, to the number of about 1200, which was declared to be a record. The next place of meeting will be in Holland five years hence. It is perhaps a sign of the times that Russian delegates did not put in an appearance, although expected, for some unknown reason. This was a distinct loss, for the botanical work in Russia has always been of a high order. Botany is a very different science at Cambridge and elsewhere, from what it was some fifty years ago, when the learned Professor resisted all attempts to introduce studies on the life and internal structure of plants. He held that botany was concerned with the classification of plants and the building up of herbaria, and he dismissed the idea of including what he termed disparagingly Physiology into the School. Now botany is no longer one science, but a congeries of many in their relation to plants. This is brought out clearly in the list of the various sections holding separate meetings, into which the Congress was divided, each usually embracing two branches of study for the sake of convenience: Bacteriology, Phytogeography and Ecology, Genetics and Cytology, Morphology and Anatomy, Plant Physiology, Palaeobotany, Taxonomy and Nomenclature.

With such an enormous number of eminent and enthusiastic workers, it is not surprising that the meetings where papers were read and discussed were crowded; and that for the joint meetings of two sections larger accommodation was required. Two of these joint meetings proved to be of special interest to sugar cane workers: the pathologists and bacteriologists dealing with the Differentiation and Classification of Plant Viruses, and the taxonomists, cytologists and geneticists with The Species Concept. Virus diseases and classification are both of them questions of the moment in sugar cane research. Each section had an official chairman, who had power to delegate his functions when special aspects were dealt with; thus Dr. BUTLER and Sir DANIEL HALL delegated to the two joint meetings referred to above. Besides the chairman, leading exponents occupied the positions of recorder and secretary or secretaries for each section. The languages were limited to English, French and German; but the volume of abstracts of papers which was distributed was almost entirely in English. The general arrangements were excellent, and the whole Congress was loud in its appreciation of the care taken for their comfort and the smooth working and harmony of the sessions, in spite of the opposing views expressed. Social functions were not forgotten, and included an organ recital in King's College chapel, a reception in St. John's, a garden party given by the President, Professor A. C. Seward, in the grounds of Downing, and a dinner in Trinity which naturally could not include all the

delegates. Parties were taken to the scientific Institutes relating to plants in Cambridge, and a much wider series of excursions was arranged in the week following the Congress to centres of biological research in various parts of the country.

Keeping Up-to-date.

The *Sugar News*, of Manila, remarked the other day in an editorial that when sugar falls in price and the outlook is somewhat uncertain, sugar factories and planters alike begin to curtail expenditure and to defer needed improvements for another season. This in itself may be a trite observation, but our contemporary goes on usefully to remark that experience shows that periods of depression are followed by good times and those who prepare for the good times ahead are the ones who will reap the benefit when the economic outlook improves. There are certain improvements needed in every factory to render it more efficient, and these improvements should be undertaken if the economic condition of the factory will permit.

"Hard times, depressions, and whatnot, are the result of economic conditions and mental attitudes. If factories do not improve and add needed machinery, then foundries, iron works and workers in metal feel a depression. This results in the lessening of employment, a reduction in buying power, and a drop in commodity prices. In other words, modern commercial and industrial life is so far inter-related that timidity in one section breeds timidity in all. Far be it from us to advocate the useless spending of money at this time, but we do believe that a little courage is necessary. Those who are discounting the present situation and are showing faith in our industry are the ones who are showing farsightedness, and the chances are that they will reap the benefits which will be denied to those who, at the moment, are fainthearted."

There is a good deal of truth in this contention and there must be many a factory owner in some part or other of the world to whom these remarks may fittingly be addressed. But, in other cases, it must be admitted that the debasing of sugar values has gone so far that it is doubtful whether the economic condition of the factory *will* permit of the cost of much needed improvements. In this respect the industry has got within very much of a vicious circle ; but is it not here of all places that the courage above referred to is needed in order to get out of the *impasse* ? It is certainly a matter for earnest and painstaking consideration on the part of those in control.

Keeping on Advertising.

The complement to the above argument is suggested by some remarks reported as having been made by the chairman of a very big manufacturing corporation, the Gramophone Co. Ltd. (H.M.V.), which supply a word in season for those who manufacture the goods. "If you cease to advertise regularly (he said) you lose ground which you can never make up again." And he went on to quote the late LORD NORTHCLIFFE's view[1] that in times of depression one should always increase one's advertising (whereas, we may remark parenthetically, the reverse practice is far too commonly the case). "We do not look for immediate results from an advertisement. We consider it more as a system of building up goodwill with our customers and prospective customers. They may not be inclined to buy anything at the time that the advertisement appears, and the advertisement may not make any immediate

1 He was the creator of the Harmsworth publishing business.

change in their attitude; but, by regularly and constantly advertising, we are making an impression and when the time comes for them to buy anything that we sell they will remember our advertisement. That is the only way that real profits are reaped from advertising." . . . "So that is my advice to other traders. Keep on advertising, and do not look at it so much from the point of view of quick sales as of establishing an invaluable good will."

City and Guilds of London Institute's Examinations.

Arrangements were made by the Department of Education, Union of South Africa, to enable students to sit for the City and Guilds of London Institute's examinations in sugar manufacture. In Grade I there were 21 candidates, and 16 for the Final from that country. There were also a fair number of entries from other sugar-producing countries, as well as from the United Kingdom. Intending candidates anywhere should make their entries before March 9th, 1931, addressing them to the nearest Technical School; or they should communicate with: The Superintendent, Department of Technology, City and Guilds of London Institute, Exhibition Road, London, S.W.7, who will inform them of the nearest centre at which their entry would be accepted. The following are examples of the papers set:—

Grade I.—(1) Define *any six* of the following terms:—*Acarus sacchari*; fructose; clairce; osmosis; jaggery; melassigenic; stool; seed-ball. (2) Describe *either* the planting of the sugar cane, *or* the sowing and cultivation of the sugar beet. (3) How would you proceed to determine the purity value of a sample of molasses? What is "apparent purity," and "true purity"? (4) What is the action of milk-of-lime on *either* raw cane juice, *or* raw beet juice? (5) Describe, with the aid of a sketch, *one only* of the following:—A juice-strainer; an air-pump; a trash turner; an anti-entrainment device. (6) Sketch a modern saccharimeter, and describe briefly the principal parts and their purpose. (7) Write a brief practical account of the operation of juice or liquor filtration, using a plate-and-frame press. (8) What is the average composition of the following:—Cuban 96° sugar; raw beet sugar, 90° nett; cane molasses; beet molasses; "pieces"; Demerara yellow crystals? (9) To what purpose are the following materials put in sugar manufacture or refining:—Formaldehyde; hydrochloric acid; phosphoric acid; caustic soda? (10) Give a short account of the utilization of *two only* of the following by-products:—Bagasse, beet-pulp; cane molasses; beet molasses.

Final.—(1) Define *any six* of the following terms:—Stalagmometer; millilitre; suspensoid; ketose; zymase; buffer solution; sereh; saline coefficient. (2) Discuss briefly the essential operations involved in the harvesting *either* of the sugar cane *or* of the sugar beet. (3) Write a short account of the importance of hydrogen ion concentration in *either* sugar manufacture *or* refining. (4) What are the causes contributing to scale formation *either* in the cane *or* in the beet sugar factory? State the composition of some typical evaporator scales. What steps would you take for the purpose of diminishing scale formation? (5) State the functions of: (*a*) The condenser, (*b*) the water-pump, and (*c*) the air pump of a central barometric condenser installation. (6) Outline how you would analyse *any two* of the following materials used in sugar manufacture or refining:—Caustic lime; sulphur; kieselguhr; new bonechar. (7) With which types of vacuum pan heating systems are you acquainted? What are their advantages and disadvantages? (8) Write a short essay on raw sugar deterioration in the warehouse, its causes, and its prevention. (9) Give a short account of the several non-sugar substances present *either* in raw cane juice *or* in raw beet juice. What happens to each of them during manufacture? (10) Write a short essay on heat economy *either* in the raw sugar factory *or* in the refinery.

The European Beet Sugar Crop of 1929-30.

By Dr. H. C. PRINSEN GEERLIGS, Ph.D.

The figures for the 1929-1930 European beet sowings, expressed in hectares, and those of the sugar production in metric tons, raw value, are given here, together with those for 1928-29 as a comparison :—

	1928-29		1929-30	
	Hectares	Tons sugar	Hectares	Tons sugar
Germany	430,307	1,851,263	433,015	1,964,748
Czecho-Slovakia	250,475	1,042,948	227,258	1,017,877
Austria	27,695	107,322	29,687	120,370
Hungary	65,503	220,062	72,975	246,513
Poland	230,385	756,889	242,014	928,689
France	239,725	903,075	243,100	908,738
Belgium	58,291	279,290	53,550	252,048
Netherlands	65,255	319,937	55,002	264,871
Denmark	41,200	170,000	29,990	135,000
Sweden	42,621	160,860	27,467	121,000
Italy	112,120	367,334	116,111	440,822
Spain	84,000	262,000	80,000	245,000
Danzig	7,773	30,000	7,561	30,000
Yugo-Slavia	60,959	129,000	61,228	132,000
Bulgaria	17,000	29,870	20,000	40,000
Rumania	52,000	130,000	36,000	82,000
Switzerland	1,600	7,000	1,160	6,000
United Kingdom	71,200	222,590	92,800	325,000
Ireland	6,100	22,500	4,800	20,000
Finland	2,800	3,387	1,476	3,000
Latvia	2,000	2,000	2,000	4,000
Turkey	3,600	4,000	3,000	6,000
Russia	769,000	1,446,000	784,000	910,000
Total	2,641,609	8,467,324	2,624,194	8,203,676

The total area under beets has undergone a very slight reduction, by 17,000 hectares or 0·6 per cent. In some countries, as Czecho-Slovakia, Netherlands, Belgium, Denmark, Sweden and Rumania, the sowings have been reduced as a consequence of the low price of sugar, but, on the other hand, Hungary, Poland, Italy and the United Kingdom have extended them to an appreciable degree.

The sugar production dropped by 263,000 tons, or about 3 per cent., a decrease from 3·20 tons per hectare to 3·12 tons. It was especially Russia which showed poor results, with 1·16 tons, whilst the others have remained at the same level as in 1928-29. Leaving Russia out of account, the tonnages per hectare were 3·75 in 1928-29 and 3·96 in 1929-30, thus showing that the year was all round a favourable one in Western and Central Europe.

Consumption amounted to about 10,000,000 tons raw value, against 10,175,000 tons in 1928-29, thus indicating a decrease, whereas in other years a steady increase had been recorded. It looks as though the bad state of trade in Europe has curtailed sugar consumption as well as the consumption of every other article which is not absolutely indispensable.

In GERMANY 238 factories have been active, against 248 in 1928-29 ; the sugar production was 4·54 tons per hectare, against 4·30 tons in the previous year ; this notwithstanding the dry summer, which threatened the growing beet crops. In October, however, the rains set in and did much good to the roots, thereby saving the crop. This country has consumed about 1,670,000 tons of sugar and the Exporting Committee has allowed the exportation of 15 per cent. of the crop or the equivalent of about 300,000 tons

of raws. The initial stocks amounted to 255,000 tons, the final ones to 370,000 tons, thus leaving the country overstocked at the beginning of the new season.

In CZECHO-SLOVAKIA only 141 factories worked, against 151 in 1928-29. The sugar production amounted to 4·49 tons to the hectare, against 4·17 in 1928-29, an increase which was even better than was anticipated during the summer. Exportation amounted to 600,000 tons, which was dispatched to Trieste and Hamburg in transit, Asia Minor, Austria, Switzerland, etc., thus showing that the loss of the English market has already been discounted by diversion to other destinations.

The efforts attempted in AUSTRIA to become independent in the supply of sugar have made some progress, since the production increased by 13,000 tons or by 12 per cent., and the number of factories rose from 6 to 7. Anyway, it has remained still insufficient to cover the demands of the country, since some 100,000 tons, raw value, had to be imported from Czecho-Slovakia and, to a small extent, from Hungary.

In HUNGARY also the sugar production resulted in an increase; the planted area was extended from 65,303 hectares to 72,975 and as the agricultural results were satisfactory the sugar production swelled from 220,062 tons to 246,513, or by about 12 per cent. The country consumed about 110,000 tons and consequently had available for export some 137,000 tons. The destination of that sugar was Austria, the Balkan States, British India, and other overseas countries, and notwithstanding the keen competition only an inconsiderable amount failed to find an outlet, so that the final stocks were not much larger than the initial ones, only being a few thousand tons in either case.

POLAND largely increased her sowings, which expanded from 230,385 hectares to 242,014. The crop reaped from this area was so good that the total sugar output rose from 756,889 tons to 928,689, i.e., by 172,000 tons or 21 per cent. This is equivalent to 3·29 tons of raw sugar to the hectare in 1928-29 and 3·75 in 1929-30. This large crop, just as in every other exporting country, was difficult to dispose of. Poland itself requires only about 400,000 tons, thus leaving more than 500,000 tons for export. Raw sugar was sent to Great Britain and Holland, and white sugar to the Russian Border States, the Balkan countries, etc. As, however, the amount of sugar to be exported was much larger than usual, the stocks on hand increased from 81,000 tons on 1st September, 1929, to 140,000 on 31st August, 1930.

In FRANCE both the planted area and the tonnage of sugar remained almost unchanged. The country imported some 100,000 tons from its colonies in America and Africa, as well as from Java, Cuba and Belgium, and exported to its dominions, protectorates and provinces in Northern Africa. The home consumption amounted to about 1,050,000 tons or slightly more than the home production plus that of the colonies, Réunion, Martinique and Guadeloupe.

Owing to the low price of sugar the area planted with beets in BELGIUM was restricted from 58,291 hectares to 53,550 or by 4,741 hectares (8 per cent.). Of the beet crop a part was exported to France, but, on the other hand, Belgium imported roots from the Netherlands, so that the sugar produced has no direct bearing on the area harvested. The country imported raw sugar for refining and re-exportation, and consumed about 256,000 tons. It also exported sugar in sugared products, which sugar was partly the home product and partly the imported article. The total consumption as a rule either equals production or else remains slightly under.

The European Beet Sugar Crop of 1929-30.

In the NETHERLANDS conditions were, on the whole, identical with those in Belgium. The area shrunk from 65,255 hectares to 55,002 ; the number of working factories from 16 to 12, and the sugar output from 319,937 to 264,871 tons. Since a great deal of beet has been exported to Belgium and France, the sugar produced cannot be calculated back to the hectare planted. The Netherlands imported raw sugar from Danzig, Poland, Germany, Cuba, Peru, Surinam, San Domingo, etc., and exported refined sugar to Great Britain, Scandinavia, Irak, etc.

As a consequence of the low price offered by the sugar manufacturers the beet growers greatly restricted their sowings in DENMARK, viz., from 41,200 hectares to 29,900 ; sugar production fell accordingly from 170,000 tons to 135,000, and much more than usual had to be imported to supply the country with the 210,000 tons, raw value, which it requires.

Conditions were very much the like in SWEDEN, with a planted area of 27,467 hectares against 42,621, a sugar crop of 121,000 tons, against 160,860, and a consumption of 240,000 tons.

Quite another note is heard from ITALY, where, at last, the sugar industry has been successful in producing so much that the demands of the country are fully covered. In 1929-30, 116,111 hectares were sown with beets against 112,120 in 1928-29, and the production increased to 440,822 tons, or 3·71 to the hectare, as compared with 367,334 tons or 3·40 to the hectare in the year previous. As consumption may be put down at 380,000 tons, there is a surplus, which owing to the high cost price cannot be exported, but remains in the country as stock for next year.

In SPAIN matters have remained unchanged ; the country produces about the same quantity as it consumes and imports a little from Cuba.

In GREAT BRITAIN sowings were extended from 71,200 hectares to 92,800, and sugar production increased from 222,590 tons to 325,000. The official figures may be found on page 363 of our July issue, to which we would refer in order to prevent needless repetition.

In the BALKAN STATES conditions did not change materially ; in one place the crop increased, in another decreased, and the total figures are :—

	Area	Production, Tons	Consumption
1928-29	129,959	288,870	—
1929-30	117,228	254,000	290,000

thus showing a slight total decrease .

Notwithstanding the great efforts of the RUSSIAN authorities to increase beet sugar production, the results have been very small ; the sowings were about the same, but sugar production dropped from 1,446,000 tons (or 1·87 tons to the hectare) to 910,000 tons (or 1·16 to the hectare). As we have shown above, this poor Russian result has lowered the total European figure as well as the average.

The OTHER COUNTRIES include Danzig, Switzerland, Ireland, Finland, Latvia, Turkey, with sowings of 20,000 hectares, against 23,873, productions of 69,000 tons in both years and consumptions of 830,000 tons against 780,000.

Europe has produced 8,400,000 tons, consumed 10,000,000 and has needed for exportation to Northern Africa, Asia Minor, British India and other places about 550,000 tons.

The total requirements therefore exceeded production by 2,150,000 tons, which deficit was supplied by Cuba, Java, San Domingo, Peru, Mauritius, South Africa, Mozambique, British West Indies, Demerara, Réunion, Martinique, Guadeloupe, Surinam and Fiji, either direct or through American and Canadian refineries.

Cytology, and its Use in the Classification of Canes.

Cytology is the name given to the study of the cell and its contents, whether in plants or animals, and the subject cannot be even approached by the general reader without some sort of explanation. From the nature of the case, the study can only be conducted under a high power microscope, using a complicated technique, to which should be added on the part of the worker, if plants are dealt with, an intimate knowledge of the anatomy or internal morphology of the plant body. The following brief introduction is inserted for the purpose of placing sufficient data before the readers of this Journal, for them to be able to gather " what it is all about " : and thus to be able to appreciate the importance of Cytology in all studies connected with the origin and classification of our cultivated sugar canes. The subject is therefore presented in the most general terms, avoiding as far as possible the special vocabulary created by and necessary to the workers in the subject.

The end of each stem or root of a plant, termed the growing point, is soft and tender; and consists of extremely minute cells in an active state of division. In these and other formative parts of the plant the cells are young and similar, and as yet undifferentiated for any special purpose. Each cell is surrounded by a delicate cellulose membrane, the cell wall, and is filled with semi-fluid protoplasm interpenetrated with food material. Being closely packed, they are more or less rectangular in section ; and the tissue which they form presents an ideal matrix for microscopical examination, after appropriate treatment with fixing, hardening and staining re-agents. By cutting very thin sections, we can then get a very clear idea of the internal anatomy of the cells and any changes which take place in them, especially when they are undergoing sub-division and consequently multiplication.

In each cell a certain portion of the protoplasm may be distinguished as a rounded mass, denser than the rest and staining more deeply, and thus standing out in the stained sections. This is called the cell *nucleus* and it is separated from the rest of the protoplasm, which bears the name of *cytoplasm*, by a firmer outer layer of its protoplasm, which we call the *nuclear membrane*. When we examine the stained nucleus we find that its structure is much more definite and complicated than that of the cytoplasm ; and moreover that striking changes take place in its structure during cell division. And it is with these changes that we are at present concerned.

When the nucleus is at rest it appears, in the main, to consist of an extremely fine network, often difficult to make out. But when the cell in which it is situated is about to divide, the following changes take place in rapid succession. The network contracts and becomes thicker at certain points, thus forming a series of separate fibres which stain more readily than the rest of the nuclear contents. These fibres are called *chromosomes* ; their outlines rapidly become very distinct, and they then undergo a series of complicated evolutions. The nuclear membrane disappears and they are free to move to any part of the cell, finally taking up a position where the next dividing cell wall will be laid down ; and each chromosome splits longitudinally into two halves. These halves next separate by a sliding movement and proceed to opposite ends of the cell where they form irregular groups. The cell wall is then laid down across the middle of the cell, and the single cell becomes two, each of which contains a half of each chromosome. The separated halves then pass through all the stages mentioned above, but in the reverse order, till the rather indefinite net-work is again formed with a fresh nuclear membrane, and the daughter nuclei enter the resting stage, each in its own new cell.

Cytology, and its Use in the Classification of Canes.

It is obvious that, for some reason, it is important that the number of chromosomes should not be altered when a nucleus divides, and also that all parts of each chromosome in the mother nucleus should be represented in the two daughter nuclei. And this reason is not far to seek. The nucleus has long been suspected of being that part of the protoplasmic body of the plant which bears the hereditary principle ; and it has now been shown that the chromosomes are the part of the nucleus to which this duty has been assigned. The number of chromosomes remains constant in the tissues of each plant, and is also characteristic of the species to which it belongs ; these numbers varying from, say, half a dozen to over a hundred in different plant species. And the same appears to hold good, regarding their size and form and other observable characters. There is, moreover, reason to believe that the various characters hitherto used in distinguishing plants from one another may be distributed to different chromosomes or even to different parts of them. From all of which it must be conceded that cytology is capable of assisting the taxonomist in his laborious work of classification. That such assistance is needed is obvious to anyone who has ventured into this part of botanical science.

The above brief account of nuclear division applies in general to the formative tissues of the higher plants, and represents it in its simplest form in these. When, however, we turn to the reproductive organs, in which every new plant is laid down, complications arise ; the first and most obvious one being that such a new plant is produced by a fusion of the male and female reproductive cells. Here special arrangements are required to maintain the number of chromosomes in each succeeding generation. And this is effected by a reduction of their number by one half during the formation of the sexual cells ; in the pollen grains by the simple expedient of leaving out the splitting of the chromosomes. In the higher plants the anthers, during pollen formation, afford very favourable material for cytological studies, and they are largely used. Such material has, however, half the number of chromosomes characteristic of the plant. Hence the terms *haploid* (single-fold) and *diploid* (double) or *somatic* (of the body), which will be used later in this article.

In spite of the clock-like regularity in the nuclear division, which is the rule, there are many chances of failure, as, for example, in the incomplete separation of the chromosomes, their losing their way and appearing elsewhere in the cell, or their simply dropping out. And if such an irregularity persists in successive generations it may have as its consequence an effect on the external characters of the plant. While then cytology is well fitted in general to confirm the relations of different plants to one another, and even to test the validity of the systems built up by taxonomists, it cannot be taken in the present stage of our knowledge as an absolute guide. We may thus regard cytology rather as a fresh means for obtaining precision on the part of the taxonomist than as revolutionizing the older classifications ; and perhaps in the present state of our knowledge there may be a tendency to overestimate its importance.

The study of the cytology of the sugar cane and its allies is of comparatively recent date ; and as a matter of fact it has only attained to any great degree of development in Java, and there in the hands of one worker. G. Bremer published the results of his earlier studies of the cytology of the species and varieties of Saccharum in 1922, with further important contributions in 1924 and 1928. Throughout these investigations the relation of cytology to classification has held an important place, and he has

apparently worked in close collaboration with those engaged in systematic work in the island, among whom JESWIET was the most prominent. And at the third meeting of the International Society of Sugar Cane Technologists, held last year in Java, a paper written by BREMER and a public lecture delivered by him are printed in the Proceedings. In his lecture he deals with the work of the preceding ten years, restricting himself to the elucidation of what he considered the most important questions which had presented themselves. The following extracts from this lecture will serve to illustrate the close liaison established by BREMER with his taxonomic colleagues, and the important services which his cytological studies have rendered them. These extracts are drawn from that part of his lecture devoted to the species *S. officinarum* and *S. spontaneum* with especial reference to the reputed hybrids between them occurring spontaneously in the Malay Archipelago.

The basic number of chromosomes in the Andropogoneae to which Saccharum belongs is 10. The higher numbers of the genus Saccharum are built up from this number, how we do not know, but probably by crossing and mutation. The lowest number of what is certainly Saccharum is 30 haploid. *S. Arenga* has 15, but JESWIET is uncertain whether this species belongs to the Saccharum genus. *Saccharum officinarum* shows 40 haploid and 80 diploid, and is therefore an octoploid form (among the Andropogoneae). But many Saccharum forms do not show multiples of the basic number. Thus *S. sinense* has 58 haploid, this deviation probably originating from crossing or chromosome aberration.

Saccharum spontaneum in Java, called locally Glagah, has exactly 56 chromosomes haploid. But HARREVELD in 1921 found in the north of Celebes a variety slightly differing from Glagah and called locally Tabongo. Its flag was broader and longer, the stems were very slender and the internodes longer, and the arrow not yet adult was much more tightly enclosed by the leaf sheath, than in the Java Glagahs. Examination of this form showed the chromosome number to be 40 haploid ; which suggests that there are two different groups of the Glagah types of *S. spontaneum*. Since then, reports from Hawaii and the Philippines indicate that the Glagah varieties there are smaller than the Java ones : " this seems to agree with my supposition that the islands north of Java have another type of Glagah varieties, which have 40 chromosomes in the haploid stage." Here we have an example of a cane with only slight external differences from the type, but with very different chromosome numbers ; and the latter fact shows that a new grouping of the *spontaneum* varieties will be necessary.

Another example refers to the Toledo cane received at the Java experiment station some years ago from the Philippines, and then thought to be a natural hybrid between *S. officinarum* and *S. spontaneum*. The number of chromosomes in Kassoer is 136, and that variety is considered to be a natural cross between the two species. In such crosses the number contributed by the noble parent is found to be doubled : 80 + 56 = 136. But on examining Toledo in 1929, BREMER found that its chromosome number was 120, which would indicate that it is a hybrid between the noble cane and Glagah Tabongo : 80 + 40 = 120.

A third, puzzling case is afforded by a cane called Tanannge, received from Celebes and Borneo. This cane showed characters of both *S. officinarum* and *S. spontaneum*, and was planted with the Kassoer group ; " but it cannot be denied that these characters are combined in a way different from our Kassoer." For the Tanannge cane showed on examination 30 chromosomes haploid, which would mean 60 somatic ; and one can say with certainty that it is

quite different from Kassoer with 136 and Toledo with 120. "Considering the low chromosome number and the fact that it is a multiple of the basic number 10, I supposed in 1924 that Tanannge belonged to an unknown species of Saccharum; and JESWIET suggests that it possibly may belong to the species which he detected in 1928 in New Guinea and which he named *S. robustum* . . . From these cases it will be plain that important questions about origin and classification of cane forms will be acquired by cytological investigations, but the best results will be acquired by a combination of cytological and morphological research."

The cytological work of tracing the number and behaviour of the chromosomes of the nucleus in cell division in the sugar cane is an extremely laborious and exacting piece of work, because of their comparatively large number; and BREMER in his lecture emphasizes this point as follows : "Much work has still to be done in this direction (our knowledge of the original cane forms) and I should appreciate it very much if other investigators also would take part in the cytological work, since the investigation of our species crossing takes so much time." There are many reasons why this challenge should be taken-up. Besides the impossibility of one worker adequately covering the ground, the forms dealt with in Java have naturally been those in which that country was especially interested : in other countries the venue would be altered, and particularly in India, with its multiplicity of indigenous forms of cultivated canes, as well as, to all appearance, of *Saccharum spontaneum*, which afford a rich field for cytological work in conjunction with classification studies.

C. A. B.

Cane Breeding Work in Hawaii.

The Report of the Committee in charge of the Experiment Station of the Hawaiian Sugar Planters' Association, for the year ending September 30th, 1929, maintains the high standard of research alluded to in our review of the previous year's work.[1] There are many items which it would be interesting to notice, such as for example, determining the optimum age of the canes for harvesting, and the effect of saline irrigation water, molasses, and various artificial manurial elements upon the structure of the soil. But the space available for the present article only permits of a brief resumé of the section dealing with the cane breeding work of which a continuous if inadequate record must be maintained. The Report of this line of work was presented to the Committee by A. J. MANGELDORF and C. G. LENNOX, although many other workers are mentioned as having taken part in it.

The opinion is expressed that hopes of the discovery of a variety with unusual vigour still rest with hybrids from inter-specific crossing, because the seedlings thus obtained often show greater vigour than either parent. Four distinct lines of descent are now available—the noble canes, Uba, Chunnee, and Kassoer which was recently added ; and these or their derivatives were freely crossed during the year under report. Knowledge has been gained as to the general class of seedlings obtained by many different combinations of parents, and this has allowed of concentration on those known to produce a large number of superior ones. When such a combination is tried for the first time, it is usual to do so on a small scale, in order to determine the quality of the seedlings. Added to this, selfing of all pollen varieties has been followed, in order to gauge the degree of self fertility or sterility, and the

[1] *I.S.J.*, 1929, 65-70.

seasonal effect on these characters, and also to produce seedlings which, at a later stage, can be used for breeding.

There were certain minor changes in technique. The use of 0·03 per cent. solution of sulphurous acid for keeping the tassels alive was continued. Four-gallon tubs served as containers, each one holding 10 to 15 cane stalks; but, since the solution was found rapidly to lose strength, a certain quantity of 3 per cent. solution was added daily to each tub; and the solution was completely changed every third day. A segment of cane was cut off from the end of each stalk every second day. Meantime experiments were made with this and other solutions, for the purpose of prolonging the life of the stalks, with the following results. The presence of sunlight is essential for the long life of the stalks placed in sulphurous acid solution. The presence of trash, etc., in the solution was found to be detrimental, while that of sulphuric acid was not toxic to the cane stalks. Mixtures of sulphurous and nitrous acids generally gave better results than the sulphurous acid alone; while very good indications were observed that the same applies to orthophosphoric acid in combination with the sulphurous acid.

For the fertilization of plants growing in the soil, the female varieties were planted during the previous year in the gullies and ravines of the Federal Experiment Station; and when these flowered, tubs containing the male tassels were placed in close contact around them; shaking the male tassels gave a very satisfactory covering of the stigmas with pollen. Pollen of many of the varieties used as males was stained and preserved on glass slides. These will be kept and used in future studies on pollen fertility. Extensive work was also done in perfecting the technique for artificial germination of pollen grains. Lastly, with the co-operation of the University of Hawaii, a number of flats containing cane seed in various stages of germination were X-rayed, and the resulting seedlings planted out. This was an adaptation of the method adopted by Dr. STADLER of the University of Missouri, who was quite successful in producing mutations in barley subjected to the same treatment.

During 1928-1929 most of the breeding work was done by the staff of Makiki station (Oahu), and some 800 combinations were tried, of which 160 produced fifty or more seedlings which could be transplanted to the field. In addition, some 200 individual varieties were selfed. Nearly all the fuzz of the crosses was planted at Makiki, with bottom heat as on previous occasions. The new greenhouse accommodated all the seedlings until they were large enough to be transplanted. Fuzz and sometimes flats of seedlings were sent to the other islands to supplement those raised locally. Comprehensive Tables are given containing censuses of the seedlings raised during the year and planted at Makiki, Hilo (Hawaii), and Maui, these being classed according to the four lines of descent mentioned above. The total numbers were: 54,345 at Makiki, 14,251 at Hilo, and 11,855 on the island of Maui.

The following procedure was adopted on the Makiki plots. Every seedling received a permanent number on being removed from its pot and planted out. At 12 to 13 months of age the seedlings were stripped of their dried leaves and trash, and examined by two independent observers as to their general appearance. A record was taken, for all seedlings considered good or doubtful, of the amount of tasseling, condition of top, number of stalks, and Brix (in a composite sample of saw-cut sections of five stalks in the stool). From these data seedlings for the second Field Trial[1] were selected. At the Kailua sub-station a less detailed study of the seedlings was made. When they were 12 months old, the field was burnt; each seedling was cut and all

[1] See last year's review.

the material was heaped up over its stubble. Again two selectors inspected each pile, and decided whether the seedling was worth going on with. If so, a numbered stake was driven into the centre of the stubble and a Brix reading was taken from saw-cut sections from the middles of five stalks; and from this reading and the general appearance, selection was made for seedlings to be planted in Field Trial 2. At the same time the seedlings were ratooned, so as to be able to study the relationship between the characters of the ratooned seedling and those of its set plant. Altogether 1448 seedlings were selected from among those raised at Makiki and Kailua for growing in Field Trial 2.

It is expected that Kailua will furnish most of the tassels which will be used for breeding with during the next season. For this purpose all the seedlings of the island group as well as imported canes have been planted in areas large enough to give tassels for many hundred interesting combinations. The new glass house at Makiki was found most valuable for keeping stalks alive longer, and it will be used for the last stages of maturity of the tassels. The usual list of seedling trials—preliminary (with only one replication or with very small plots), semi-final (with two or more plots), and final (with five or more)—is given for those estates which have taken up this work in Maui, Kauai, Hawaii, and Oahu. Only those trial plantings are listed from which dependable yield figures can be obtained. And the Report concludes with summary statements as to the most promising seedlings hitherto raised or imported for the various environments met with in the islands, i.e., mauka, midland, makai, and swamp land. As these terms may not all of them be generally understood, and frequently occur in Hawaiian publications, it has been considered to be worth while to copy their descriptions for general information.

Under a classification of *mauka conditions*, one generally includes the rather infertile, granular soils of the upland rain districts. Cane in these regions is not under irrigation and generally must be of a vigorous-stooling, fast-growing type to combat the severe weed infestation. It must be capable of withstanding severe drought, should such arise. *Midland conditions*, whose boundaries are impossible to establish, may be defined as those regions which are capable of producing heavier tonnages than the fields of the mauka conditions, but still cannot produce the heavy tonnages of the extreme lowlands where canes of H 109 thrive. For these conditions a heavy-stooling, medium-sized-stick cane would seem close to an ideal type. *Makai conditions* include the greatest portion of the sugar-producing land in these islands. The fertile, irrigated fields on which H 109 flourishes so well all fall under this classification. The seedlings in this section are classified according to their resistance to eye spot. *Swamp land conditions* include the lowland fields which are largely composed of heavy, impermeable clays. Although these climatically are ideal for H 109 conditions, the soil is not suited for varieties of this type. Unfortunately little information is available concerning varieties which are most suited for these conditions. It may be noted in passing that, of the POJ seedlings imported, in mauka conditions POJ 36 is "offering the standard varieties the keenest competition," and POJ 213 seems well adapted for mauka soils. For midland conditions POJ seems to be the favourite, while POJ 2714 is the most popular of the newly imported canes. Under makai conditions POJ's 36, 2714, 2727 are resistant to eye spot and find their place in the list of most promising seedlings; while POJ 36 and POJ 2714 have shown good promise in plant crops in swamp land conditions, and will likely do well in their ratoons.

C. A. B.

The Need of Financial Leadership in the Sugar Industry.

The Example of the Swedish Match Industry.

By E. L. SYMES.

It is probable that at no other time in recent years has the lack of efficient leadership in the sugar industry been so keenly apparent. World leaders such as DETERDING in petroleum, the BEHN brothers in telephones, and KREUGER in the match industry are bringing about agreements and international consolidations in their respective fields that will stabilize their industries and provide for future steady growth. The concentration of financial control of the Cuban sugar industry in New York may open an avenue to the solution of its present troubles if a strong leader can be found having the confidence of the banking and producing groups. During the past decade many loans to foreign governments have been floated in New York, and continual payments of interest, etc., are being sent to that centre. Many of the taxes necessary for these payments are collected on sugar and mainly as internal revenues in the production and sale of this commodity. If it were possible to expand the consumption of sugar it would then be practicable to reduce the taxes without sacrificing the total income from this source. Lower taxes would give cheaper sugar and this would in itself tend toward increased consumption. The Swedish match industry has used this procedure in many countries by participating in the loans floated and securing a monopoly on the distribution of matches on which a tax is collected to amortize and pay interest on the loan extended. While no great expansion in the use of matches could be achieved, the opportunity to introduce some of the Swedish production in the new market is an advantage.

The possibilities for increasing consumption of sugar in many European countries are very encouraging, due to the low rate per capita now being used. Attention has been called to this opportunity before, and now it is of interest to consider a few low consuming centres having seaports into which ships from Cuba might discharge sugars without expensive trans-shipment. Recently cargoes have cleared for Odessa and there are several Black Sea countries whose consumption is now low. Bulgaria, Rumania, Ukraine in addition to Turkey, Greece, Jugo-Slavia and Spain on the same trade route have a total combined population of more than one hundred million people consuming around 15 lbs. of sugar per capita per year, a total of 670,000 tons. By proper management this consumption could be increased to 45 lbs. or well over 2,000,000 tons of sugar. Other European countries are consuming at this rate and up to 90 lbs. per capita, so that it is not an impossible project. It has been estimated that the annual payments on loans by these countries are well over $200,000,000. The formation of a sugar monopoly in each of these countries to take over the regular domestic production at a fair price and stimulate the consumption by importations of cane sugar should assist greatly in the collections needed for these payments.

There is little distinguishable difference between refined beet and cane sugars, but when the raw sugars are brought together it is easy to select the one that is appealing in flavour and taste as that produced from cane. It is well known that many millions of the population of these countries are unable to afford white beet sugar and when it is necessary to get along on raw or low grade beet sugar, the difficulty in expanding the consumption is apparent. Raw cane sugar has been used by the country people in Cuba and other cane sugar lands for centuries and it could be used for distribution

to this class of consumers in countries where only low grade beet sugars are now being used. In Cuba there is also produced a light-coloured sugar called *turbinado*, of about 99 pol. which would be suitable for this trade. The Hershey whole sugar, described on page 166 of this Journal for March, 1930, is also available and of a superior flavour and taste. The greatest sugar consumption rate has been reached in those countries where cane sugar is most abundant, and the surplus producing capacity now existing in cane growing centres can all be profitably operated as soon as a real leader arises who can visualize the possibilities and can inspire the financial and moral backing needed for this campaign to stabilize the world's sugar industry. It cannot be done by restrictions, but by seeking and developing new markets. An International Sugar Corporation is needed, one capable of buying the present apparent surpluses at the bargain prices prevailing and selling them through subsidiary distributing organizations in various countries where sugar has not obtained its proper place in the food budget of the nation.

The British West Indian Sugar Industry.

Some Data culled from the Sugar Commission's Recent Reports.

The Report of the West Indian Sugar Commission which was presented to Parliament in the Spring has already received notice in our pages in respect to the Commission's recommendations.[1] A final section (Part IV) of the Report has only just been issued for public use.[2] The whole Report gives a very detailed picture of the economic, social, and ethnological conditions in the various British West Indian sugar colonies. Below we give the principal data relating to sugar production in the different territories, as culled from the pages of this Report. These data relate to conditions as at December, 1929.

Barbados.

Barbados has an area of 106,470 acres, of which 67,682 are estimated to be cultivable, and of these 35,000 acres are planted with sugar cane. This crop has been planted on the land for nearly 250 years, yet the yield per acre has been maintained and even increased, in spite of the fact that no rotation of crops in the English sense of the term is found practicable. The number of persons directly engaged in the sugar industry is about 34,000, out of a total population of 167,953, but the number of persons directly dependent on the industry is over 100,000. The rainfall is limited and every effort has to be made to conserve the soil moisture. The water supply comes largely from wells, and little attention appears to have been given to the question of irrigating the canefields.

The greater part of the land used for cane cultivation in Barbados may be divided into two distinct classes—the black soil areas, some 31,100 acres, and the red soil areas of about 15,480 acres. The cost per ton of cane harvested runs higher in the black soil districts (averaging about $4·50 per ton) than in the red ones (which average $3·74 per ton); on the basis of nine tons of cane to one of sugar the difference in cost per ton of sugar would be about £1. 8s. 6d. This difference is in the main due to the fact that in the

1 *I.S.J.*, 1930, pp. 175-179.
2 "Report of the West Indian Sugar Commission, Part IV (in continuation of Cmd. 3517)." Stationery Office. 3s. 6d. net.

black soil no variety of cane has so far been found that will ratoon satisfactorily, hence only plant canes are grown, and Ba 11569 is the variety most usually employed. In the red soil areas, on the other hand, one if not two ratoon crops can be grown, and here BH 10(12) is the predominating variety. The Commission consider this inability to ratoon a very serious deficiency and recommend that tests be immediately undertaken with hitherto untested varieties (such as Uba or earlier seedlings of Java canes or hybrids of local varieties) to obtain a satisfactorily ratooning cane on the black soils. In red soil areas they recommend the introduction of and testing of some of the newer high-yielding varieties, for example POJ 2878.

In respect to cultivation, very large quantities of pen or stable manure are used in Barbados, and in addition a considerable quantity of artificial fertilizers is imported. The ploughing is chiefly done by oxen, but the subsequent cultivation of the growing canes is principally by hand and is very thoroughly done, as there is an abundant supply of labour available. The cost of cultivation per ton of cane is comparatively high and might be considerably reduced by the employment of implemental tillage.

There are 29 factories making 96° sugar, which during the three past years have milled an average of 556,000 tons of cane each year, equal to about 2000 tons of sugar each factory. Four factories are equipped to deal normally with about 50,000 tons of cane or say 5000 tons of sugar but grind on the average about 37,600 tons only. This size of factory is considered the economic limit for local conditions, and the Commission consider that if the existing factories of this type were worked to full capacity by diverting canes from windmill and less efficient steam plants more economical output would be possible. In fact three or four well located factories of larger capacity would be able to deal with the entire cane output of the island on a more economical basis ; but the capital cost of such factories and the necessary transport arrangements would under present conditions be too high to obtain an adequate financial return.

Chemical reports issued by 11 out of the 29 factories suggest that the work done in the well-equipped factories is comparable with that done in other cane sugar producing countries, but in no case is a factory being operated to full rated capacity.

Barbados is remarkably free at the present time from serious cane diseases, but in the realm of pests the position is not so favourable, as a very considerable toll (estimated at from 10 to 15 per cent. of the crop) is taken by injurious insects, of which the most destructive are the small moth-borer (*Diatraea saccharalis*) and the root-borer (*Diaprepes abbreviatus*).

Barbados rejoices in a Department of Agriculture whose work has been of the greatest service ; the achievements of HARRISON and BOVELL in the raising of cane seedlings are a matter of history. Many of these seedlings have found their way to other countries, and in Java, before that island had succeeded so remarkably in its cane breeding experiments, 58 per cent. of the sugar area was planted with a Barbados cane. In St. Kitts BH 10(12) and Sc 12/4 are the most favoured canes ; in Antigua BH 10(12) and B 4507 are grown ; in Trinidad BH 156 is the popular cane, and in Porto Rico BH 10(12) and Sc 12/4 are grown in 90 per cent. of the fields.

ST. KITTS.

St. Kitts with Nevis forms one Presidency of the Leeward Islands Federation. Its total area is 41,851 acres, of which about 29,000 are cultivable ; 18,000 acres are actually under cultivation and of these some 12,000 acres

are devoted to cane. The estimated population is 18,300, of which some 6000 are labourers employed in the sugar industry, but practically the whole population of the island is dependent on sugar.

The soils are of volcanic origin and of a dark grey loam, being easily worked and free from stones. They are among the most fertile in the West Indies. The island is fairly well watered especially on the northern side, but on the southern side periodic droughts cause some anxiety. Cane growing is confined to the lower lands ; the yield per acre varies considerably, depending on the rainfall ; in 1928, a favourable year, it was 24·6 tons per acre, but in 1929, a year of low rainfall, it fell to 17·6 tons. Cultivation is easy, deep ploughing being possible with ox ploughs ; but the cost of this form of cultivation is admittedly comparatively high. Improvements suggested by the Commission include a better system of conveying cane to the rail sidings, and the extended use of derricks to transfer the canes from carts to railway waggons. Manuring consists chiefly in heavy applications of pen manure, comparatively little artificial fertilizer being employed.

There are only two varieties of cane in use—BH 10(12) and Sc 12/4. Practice favours one ratoon crop only, but the condition of the growth suggested to the Commission that at least two ratoon crops were feasible. And they urge the necessity of pushing on with trials of other and newer varieties.

There is now only one central factory in St. Kitts to which all sugar producing areas are connected by means of a narrow-gauge railway. The factory is well equipped, well operated, and well-managed, and its manufacturing costs are quite comparable with those of other central factories of similar size. Its normal rated capacity is 180,000 tons of cane, or about 20,000 tons of sugar ; but this capacity has not yet been reached in practice.

The most serious insect pest causing damage to the sugar canes in St. Kitts is the small moth-borer (*Diatraea saccharalis*).

Antigua.

Antigua is the seat of the Federal Government of the Leeward Islands ; it has an area of 68,980 acres, of which 36,430 are estimated to be cultivable. Nearly 20,000 acres are actually under cultivation, of which 16,480 are under sugar cane. The population is about 30,442, of which some 9000 are directly employed as labourers in the sugar industry, forming with their dependents over 90 per cent. of the population.

The agricultural conditions are probably as difficult as, if not more so than, those in any other West Indian Colony, and the one bright spot lies in the fact that there is a well-equipped and efficiently managed central factory, capable of handling in a normal year the entire sugar crop. The island suffers from severe droughts at frequent intervals and sometimes also from hurricanes. The soils are difficult to handle, being in many places extremely heavy ; given adequate rainfall they are, however, quite fertile. Cotton is raised as a catch-crop in rotation with sugar cane.

A considerable number of different varieties of canes are grown in Antigua and POJ canes have been introduced. There is a distinct tendency to seek the variety best suited to the varying soil types rather than to look for a general purpose cane. But the standard of cultivation is in the majority of cases considerably below that of Barbados and St. Kitts. True, the frequent recurrence of drought in Antigua makes agricultural work risky, but little attempt appears to be made to conserve the soil moisture. There is more

room for more thorough and early preparation of the land by mechanical ploughing and subsoiling and the use of light implements in the subsequent cultivation. Very little artificial manure is used, pen-manuring being the principal expedient. The average yield of cane per acre for six years has been 13·9 tons, which is extremely poor.

There are two central factories in Antigua, both of which were established with the aid of Imperial grants. One of these, Gunthorpes, has developed continuously from a factory capable of manufacturing 3000 tons of sugar per annum to its present normal rating of about 15,000 tons per annum. This factory can be classed as a well-equipped modern central, obtaining a recovery of sugar quite up to modern standards. The Bendals factory has a capacity of 3000 to 3500 tons of sugar per annum, but is not equipped to obtain the average recovery of sugar required in a modern central. Additional machinery has been installed and the quality of the work considerably improved in recent years, while further improvements are contemplated.

The Antigua factories, like those in St. Kitts, have a system of payment for their canes whereby these are sold to the central factory on a sliding scale based on the market value of the sugar. Under such conditions the factory cannot make a loss unless the crop is very short or the price falls very low ; but the grower when the price falls below a certain figure is faced with very considerable losses, and there is considerable dissatisfaction amongst the planters at this inequality. The fixing of a minimum price for the cane is advocated as an equitable adjustment.

BRITISH GUIANA.

Conditions in British Guiana differ in many respects from those to be found in the different West Indian Islands. It forms part of the South American Continent and has a total area of 90,000 square miles. Of this area it is estimated that only some 200 square miles is under cultivation, this comprising chiefly a coastal strip with a maximum width of 10 miles. This coastal strip has a heavy alluvial clay soil, and in some cases is below sea level at spring tides. It is kept in cultivation by a most elaborate and costly system of sea defences, canals, drainage pumps, etc., the maintainance of which is a severe strain on the financial resources of the colony.

The population is estimated at 307,000, of which some 50,000 are labourers directly employed in the sugar industry. The number of estates and the area under sugar cane show a very considerable reduction during the last 30 years ; but the output of sugar has been maintained, thanks chiefly to improved methods of cultivation made possible by the introduction of mechanical tillage. Thus in 1897 the area under cane was given as 66,000 acres and the sugar exported amounted to 101,160 tons while in 1928, 57,600 acres were under cane and the export was 114,687 tons of sugar. The yield of sugar has therefore increased from 1·5 tons per acre to just under 2 tons. The average cost of growing and harvesting cane in 1928 was about 14s. 4½d. per ton.

The sugar crop here depends almost entirely on a locally-produced variety of cane, D 625, which replaced the rich Bourbon variety when the latter succumbed to root disease. D 625 yields a good weight of cane per acre (average over 26 tons) but it has a comparatively low sucrose content and a low purity, so that even the best equipped factories require about 10 tons of cane per ton of sugar. In view of this, the Department of Agriculture is making arrangements to continue the work of raising new seedlings and during the past year has imported many of the Java seedlings, as well as promising varieties from Barbados, Trinidad and Guadeloupe.

The use of artificial fertilizers—chiefly sulphate of ammonia—in British Guiana is pretty general, but very little green manuring or pen manuring is done. There are indications that the soils lack phosphoric acid, for there is a lack of such acids in the juice, resulting in poor clarification work in the factories. At two factories where phosphoric acid was added continuously to the juice during clarification a brilliantly clear clarified juice was obtained.

The majority of the estates resort to some form or other of mechanical cultivation of their fields. The ploughing and subsequent cultivation are very thoroughly done on many of the estates with implements specially designed and drawn either by cable power operated from punts or by direct haulage with track-laying tractors. The use of cable ploughing and cultivating tackle costs less per acre of land worked than the usual lighter tractors and ploughs; but their initial cost is considerably higher. But the better cultivation made possible by the use of these implements has been very marked, leading to increased tonnages and to a larger area being worked by the same labour force. The soil is favourable to ratooning, from three to five ratoon crops being usually grown. Nearly all the cane is produced by the estates themselves, very little being grown by peasant farmers.

In the harvesting of the cane lies the greatest room for improvement. The practice of burning off the dry cane leaves prior to cutting, due to labour difficulties, is almost universal in the colony, though now generally condemned. The burnt cane deteriorates rapidly, yet the transport organization is not such as to reduce the time between the burning and milling to a minimum; and since Sunday labour is forbidden by Ordinance it often happens that cane burnt on a Friday is not milled till the following Monday or even Tuesday. These methods of harvesting naturally conduce to low purities: as it is, the sucrose content of the cane and the purity of the juice are both low in British Guiana.

The sugar factories are divided into two groups, those of over 5000 tons per annum capacity manufacturing over 75 per cent. of the sugar out-turned (group A); the smaller and less efficient factories come under group B. The average over-all recovery of the factories in group A was 79·5 per cent. in 1928, which is considerably below the level of what is to-day considered good practice (compare 87·54 in St. Kitts, 87·63 in Antigua, 86·5 in St. Madeleine, Trinidad, and 90·44 in a Hawaiian factory milling poor quality cane and requiring 9·8 tons of cane per ton of sugar). The average recovery of B group factories in the same year was no higher than 73 per cent. While these low recoveries are in part due to low purity juices being worked, the average boiling house equipment, according to the Commission, is far from modern standards; the milling plants are on the whole in good condition, but the sugar crystallizing, curing, conveying, and bagging equipment and methods in practically all the factories can be greatly improved if funds are available.

Some centralization of factory work is indicated from the fact that the 64 factories of 1897 are now reduced to 21, turning out the same quantity of sugar; but the Commission deem that further centralization would be profitable and that before any large expenditure is incurred it is very advisable that a survey of conditions be made to ensure that an installation of new machinery is made only at a factory which may normally be expected to obtain sufficient cane to run full time. None of the factories operates a full day continuously at present, and the result is an absence of efficiency and a disproportion in overhead charges.

(*To be continued*).

The Biological Control of Insect and Plant Pests.

By ARTHUR H. ROSENFELD.

Every one interested in the biological control of either insect or plant pests would benefit by the opportunity of studying a most excellent report[1] on the "Organization and Progress of the Work of the Farnham House Laboratory," which latter was founded by the Imperial Bureau of Entomology some three years ago, by means of a grant from the Empire Marketing Board, with the main object of the furtherance of the control of insect pests of agriculture and forestry by means of what is known as the biological method. The first grant of the Empire Marketing Board was for £15,000 for capital expenditures and £5000 per annum for maintenance expenditures during the following five years. Due to the rapid development of the work of the Laboratory, the funds allotted for annual maintenance proved decidedly inadequate, and the Imperial Bureau, after a conference with representatives of the Empire Marketing Board, secured a grant of an additional £2000 per annum from 1st July, 1929. In 1929 also, at the request of the New Zealand Government, the Laboratory took over the supervision of the European end of the work on the insect enemies of New Zealand weeds and received from the New Zealand Government a special grant of £1000 per annum for this work. Small subsidies have been made by the Commonwealth Council for Scientific and Industrial Research in Australia, the New Zealand Government, the Government of Cyprus, etc.

The Farnham House Laboratory is located in a 15-room country house, about 25 miles from London, with about 6½ acres of ground surrounding. From the description in part III of the present report, the Laboratory and grounds would seem to be excellently and most modernly equipped for the work in hand and supplied with a highly competent staff.

Dr. GUY A. K. MARSHALL, the well-known Director of the Imperial Bureau of Entomology, in his preface to the report considers that the creation of the Laboratory has met a real need in Imperial entomology, as proved by the response of the Dominion and Colonial entomologists to offers of assistance. Even before the Laboratory was open for work, requests for help were received, and up to this time the list of injurious insects and plants which the Laboratory has been asked to investigate with the hope of finding natural enemies comprises some 70 species. An idea of the widespread diversification of the investigations under way may be obtained from the fact that the Dominion of Canada alone has submitted to the Laboratory projects involving the natural control of no less than 28 species of injurious insects, while Australia has submitted 16; New Zealand, 14 projects of insects and five of obnoxious weeds; South Africa, a project of biological control of the Sheep Blowfly; India, projects of Woolly Aphis and Fluted Scale; West Indies, one on Pink Boll Worm; Cyprus, on Codling Moth and Potato Tuber Moth; the Falkland Islands, on Blue Bottle Fly; and the United States of America, a project of the Pink Boll Worm and the Carrot Rust Fly. Up to the date on which this report was sent to press last June, a total of 73 consignments of beneficial insects, containing approximately 285,000 living individuals, was sent out by the Laboratory. These shipments included some 24 species of beneficial insects attacking 17 species of pests. So much for the actual progress of the work of this splendid institution which is materially adding to our knowledge of both theory and practice of biological control of agricultural pests.

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1 "The Biological Control of Insect and Plant Pests," by W. R. Thompson, Ph.D., D.Sc., Assistant Director, Imperial Bureau of Entomology and Superintendent, Farnham House Laboratory (Empire Marketing Board Publications). London: H.M. Stationery Office. 1s. net.

Probably of most interest from the reviewer's standpoint, however, is part II of the report which is devoted to a general account of the problems encountered in biological control operations with special reference to the organization and practical conduct of work in this, as yet, comparatively unexplored and most promising field in economic entomology. As Dr. THOMPSON mentions in his brief introduction, a certain number of purely theoretical considerations have been included because of their value in indicating lines of research in both field and laboratory, and, in view of the clear and concise manner in which these theoretical considerations have been handled by the author, there should be no doubt that their inclusion has added to the practical value of the work. The great majority of the statements and suggestions, however, are the fruit of a generation of practical work in this field and have the seasoned value of having been repeatedly tested and practised. This section of the report constitutes one of the most complete and understandable outlines of the whole technique of biological control that the writer has yet seen published.

The report calls attention to the perhaps little known fact that of the 183 worst known enemies existing in North America practically half have been introduced from foreign countries, the larger proportion coming from Europe The damage caused by the Hessian-fly in the United States is something like £800,000 each year, while the cost of the by no means complete control of the Gypsy Moth, accidently introduced into the States some 60 years ago, is causing that government something like £50,000 per annum loss. The European Corn Borer, an unwelcome immigrant to the United States but a decade and a half ago, is the cause of appropriations aiming at its control of around £100,000 annually, although in the single year of 1927 alone £2,000,000 were expended in an attempt to arrest its spread. The loss or expense now being caused in the United States by the Oriental Peach Moth, the Japanese Beetle and the quite contemporaneous Mediterranean Fruit Fly serves to demonstrate the enormous field for the biological control of such pests.

Dr. THOMPSON emphasizes the need of preparatory work when the entomologist is requested to utilize the method of biological control in order to prevent damage by any pest. Of course, the first step is the accurate diagnosis of the cause of the injury and in this connexion the vital importance of ready access to the councils of experienced systematists and to adequate collections and libraries is stressed. Next must come a thorough study of the literature and tabulating of the information thus obtained and then the preliminary field survey as indicated by the data in hand. The mapping out of bio-climatic areas (even though, due to lack of complete data, this must be done quite roughly), is one of the first essentials in planning a satisfactory preliminary survey, inasmuch as frequently under one set of edaphic conditions a certain parasite may be more or less effectually controlling its host, while under a different set of conditions this particular parasite may be of no practical value. After it has been decided in just what regions the preliminary collections shall be made, the points within that region likely to give a representative idea of the conditions as a whole must be selected. It is desirable to have in headquarters a collection of the most important works dealing with the climatic, agronomic and biological characteristics of the main areas in which the work is to be carried out, also as complete a collection as possible of detailed and accurate maps. Once the survey and conclusions have been made, the examination of the material at the laboratory logically follows, with particular attention to proper determination of parasites and hyperparasites, after which the choice of the species to be utilized can be made,

as well as the decision as to the advisability or otherwise of introducing several parasitic species simultaneously or attempting to obtain a certain measure of control through the initial use of one promising species to be supplemented at later dates by the introduction of others. Apparently the policy of the Farnham House Laboratory in general is to introduce one set of natural enemies at a time and observe the effect of this before proceeding further.

Now comes the large-scale collection and shipment of the parasites or predators, and under this heading there are complete and practical suggestions given for the speedy and economic conduct of this very important phase of the operations. The section on the method of treatment on reception, and that on the study of the progress of introduced parasites in the field are also carefully and illuminatingly discussed.

This section of the report concludes with a highly theoretical and yet clearly put discussion of the results of experiments in biological control in general. Many interesting mathematical considerations as well as strictly biological ones are included in this section, but the whole subject is such a complicated and involved one that no attempt can be made to review it in this limited space.

Appended to the report is an excellent bibliography of biological control of agricultural pests, in which are listed 95 articles selected from the voluminous and somewhat chaotic literature of the subject.

Sugar Cane Culture in Porto Rico.[1]

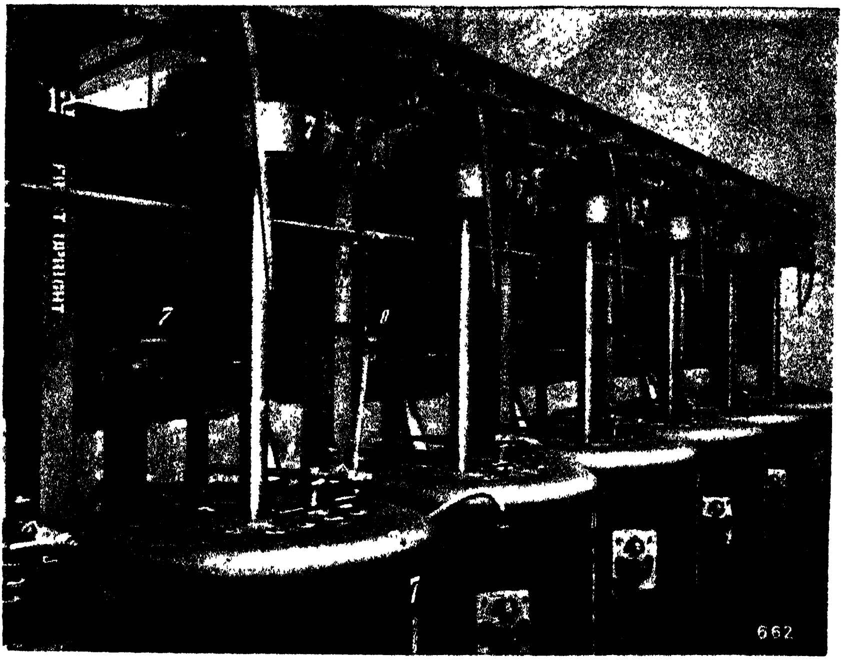
Outstanding Features in 1929.

By E. D. COLÓN.

(*Continued from page* 411.)

Tillage, drainage and irrigation will make a crop of cane, but the aim of the planter, once his stand is obtained, should be a maximum growth-rate, so that his weeding period before laying-by may be reduced to the minimum. Fertilizing under the seed for plant cane and on the stubble in ratooning will help him do this. Too many of us wait too long for this first application of fertilizers. Kilauea reports several hundred per cent. increase with this method. Later applications did not yield even a 50 per cent. increase. Another practice which has come to the writer's attention recently is the use at laying-by of a good quantity of a complete fertilizer following a previous heavy application of sulphate of ammonia, and yet it is pretty well established that potash, and, especially, phosphoric acid, must be had by the sugar cane within the first few months of growth. The trend of recent investigations seems to favour an increase of potash in cane manuring, and a more liberal last application of nitrogen, this liberality to keep pace with the proposed length of run of the crop. With the advent of the new synthetic nitrogen products fertilizing formulas and practices bid fair to undergo modifications. Full benefits in the use of our good variety of fertilizer materials will not, however, be realized until the nature of soil and plant requirements is more generally understood by those responsible for their purchase. The use of fertilizer, though, cannot correct lack of drainage, lack of water or lack of anything else but desirable chemicals in the soil. Concentration of the soil solution by the application of soluble materials during long dry spells can but aggravate the situation, because that is the very effect of drought on soils; that is, an increase

1 A Paper read before the Association of Sugar Technologists of Porto Rico, at San Juan, December, 1929.



PART VIEW OF A BATTERY OF BELT-DRIVEN CENTRIFUGALS FOR A LARGE ENGLISH BEET SUGAR FACTORY.

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CENTRIFUGALS

OF ALL TYPES,

Belt, Water and Electric Driven.

First-class Workmanship.
Substantial Design.
Best Materials.

These qualities are embodied in OUR MACHINES, and backed by SOUND REPUTATION and COMPETITIVE PRICES, we confidently solicit your enquiries.

Our Electric-driven Machines have ample Motor power, interlocked Brake and Switch, and with our latest design of suspension, a perfect machine is the result.

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No plant too small or too large for us.

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of the water-soluble constituents and exchangeable bases has been evidenced time and again by subsequent extractions. How many of us fertilized the dry flinty mud that the San Felipe cyclone left on our fields? It did not call for fertilizing then. It was fertility itself. All it needed was weathering, flocculation, intermixture. Any soluble fertilizer in contact with its high percentage of colloidal material must have been just as available to the immediate crop as were Shylock's three thousand ducats after Portia's verdict. Even ordinary soils high in colloidal matter make potash fertilization a problem. Other factors being favourable and invariable, cane growth depends within reasonable limits upon the concentration of plant food in the soil solution. Soil analysis, soil chemistry, studies this very soil solution. Why not take it into consideration as is done abroad?

But our best efforts towards a good crop of cane may be nullified by an unworthy variety of cane; and a variety of cane is known to be worthy only after several years of consistently satisfactory field and factory records. The enthusiasm for POJ 2725 and POJ 2878 has cooled down considerably in many quarters, mainly on account of their flowering proclivities and other undesirable features. This is hard luck. We needed them. BH 10/12 and SC 12/4 share now the best sections of the Island, the latter predominating on the higher lands, the former on the best lowlands. A good deal of land is still planted to Uba and the thin POJ varieties of the No. 36 type. They claim to be getting good results out of them. As long, however, as sucrose is the aim of the industry, the use of thin, high-fibre varieties can only be considered as a detour around mastery. PR seedlings 800-826 seem very promising in some cases. So also a few of the Mayagüez Station set.

While we crop in admiration a noble cane like BH 10/12, insects and diseases lie in ambush for them. It is at such an outbreak that ready technical knowledge will save the day, if available. Some of the above mentioned Porto Rico seedlings appear to be very susceptible to attacks by the *Diatraea* borer. Specially has this been noticeable since the cyclone of San Felipe. Never since 1922 had the writer witnessed such a wholesale infection of this pest. The 1929 spring-plant and the *gran cultura* following required repeated replants. In certain sections it has assumed an epidemic form. The direct measures given for its control are well known. What is not generally known or believed is the possibility of checking the damage decisively by consistently carrying these measures out wholesale for a year or two. Gangs for borer control under the writer's instructions gradually grew less numerous until the last ones had to be released for lack of work to do. Of the borer repression by means of parasites a good deal has been said; but, so far, the native ones do not seem to be as effective as we would like them to be. Foreign ones do not seem to have undertaken the job in earnest, or are still to come. It is well to note that in Louisiana the last flood of the Mississippi River had an analogous effect on insect life as on this Island. An enormous increase of some species took place. The borer on this Island was favoured by the disturbance even in zones that were the natural stop for the trash of upper valleys. One of these trash drifts alone covered approximately 8 acres of one field of sixteen. The trash is not regularly burned in this section. So, as far as this particular epidemic is concerned, trash and rubbish in and around the fields looked more like a nuisance, rather than a help. Forcing of growth with fertilizers low in potash, a going practice, will probably produce a softer cane less resistant to borer attack.

Another legacy of the San Felipe disturbance was a plague of the Noctuid grass worms. Acre after acre of plant cane has subsequently paid tribute to

the pest. Aside from the expense incurred, a one to two months growth was lost, due mainly to extensive replanting. The commonest of these worms in the Manati Valley is the army-worm *Laphygma frugiperda*, although *Mocis repanda* also did damage. The larvae may be picked and crushed specially in the first hours of the morning before the dew is off. They hide in the ground under the rubbish and in the leaf whorls to escape the heat of the sun. Dusting the rubbish and the cane foliage with 15-20 per cent. Paris green in slaked lime will be of help if done at the right time.

The white grubs of the *Phyllophaga* beetles and of *Diaprepes* have caused the usual amount of damage, in the South especially. Complaints of *Metamasius* have been heard also from that same section and of *Xyleborus* sp. from the North. The toads lately released on the Island may yet prove to be a factor in white-grub and other pests control. The search for parasites of this grub or of the beetle seems to be in abeyance. Deep ploughing, subsoiling and knifing are probably doing a good deal to keep up the good tonnages attained in spite of such enemies.

A now possibly chronic infection of nematodes, combined perhaps with an attack of minute soil lepidopterous larvae, identical with or analogous to SEIN's *Suffetula grumalis*, has probably been the main cause of failure, to economically obtain better average cane yields on the long-cultivated residual soils of the limestone hills and valleys along the North Coast. Suspecting nematode infection, in spite of the fact that the root swellings are not typical, examinations were kindly made by Dr. M. COOK at the writer's request. He found the nematode infection severe. Some measures for defence were put into practice in the new plantings and attention to the problem determined for the future. No systematic investigation of Porto Rican cane nematodes has been made here. We do not know that this particular one has already been classified. Nematode damage to cane in Hawaii has been traced to the genera *Heterodera* and *Tylenchus*. From reports, severe infectations by any of these species show above ground symptoms that would be attributed to root failure. Root-knot of various crops has been reported time and again in Porto Rico. A species of *Heterodera* is probably the causative agent of this damage and swellings on sugar cane roots. The female of *Tylenchus* does not swell.

In regard to the mosaic disease of sugar cane, the status of the measures long advocated for control in Porto Rico is, in the opinion of the writer, identical with that depicted by Dr. FARIS in Cuba, to wit :—

" In Cuba we find distinct zones as regards the rate of spread of the cane mosaic, and a very marked seasonal spread of the disease. For convenience these areas have been rated as of low secondary spread, moderate secondary spread, and high secondary spread."

" In those areas of low spread of the disease, the planting of disease-free seed in the fall of the year has sufficed to bring about practical field control without the necessity of rogueing."

"In the zones of moderately low rate of spread of the disease, *some* success has been attained in the control of mosaic by the rogueing methods so strongly advocated in the campaign in Porto Rico." " The constant vigilance necessary, the expense involved, the individuality of the colonos, and many other factors make the careful and continuous application of rogueing methods very difficult."

"In areas of a high rate of spread of the disease, while a smaller amount of secondary infection took place in the fall-planted cane, it has not been possible to bring about satisfactory field control in this way when susceptible varieties

are being planted. Therefore, it has been necessary to resort to the planting of the more resistant varieties . . . ."

" Since the resistant POJ varieties are not entirely immune to infection, the question as to whether they should be rogued of the few plants which became diseased has arisen."

" In one case we have a planting of POJ 2725 in which 20 per cent. of the plants had infection in the plant cane, and in the first ratoons this has dropped to 4 per cent. while in the second ratoons no mosaic plants could be found up to the time the cane closed. This cane was not rogued and disappearance of the disease must be attributed to recovery of this variety."

Gumming seems to have receded into the background with the change of varieties. *Ligneria* (*Plasmodiophora*) is probably still holding back the cane in soggy soils. People do not seem to be worrying about *Pokkah-Bong, twisted-top*, or even the better known of the leaf spots.

A good many, well informed, public-spirited people are, however, worrying about what the tariff policy might be, not only because of their possible interest in the sugar business alone, but because they are also interested in the social and public life of this Island. The sugar business without the protective tariff would turn chlorotic here, behind the tariff wall. Our economic life depends on the prosperity of the sugar industry more than ever before. Still this industry does not seem to enjoy the good-will of the majority of the masses. This is very unfortunate. Co-operation is necessary. Something should be done on both sides to foster a better understanding. Satisfactory transactions might, then, take the place of the strike, of litigation with the municipal branches of the government, and of the differences now common with the " colonos."

It will pay everybody when these and other misunderstandings are ironed out. When the " colonos " problem was brought up at the recent farmers' assembly, various ideas were exposed. Many of them were devoid of equity. Many colonos buy cane and re-sell it to the Centrals. No business man, " Colono " or factory owner, will willingly submit to a fixed standard of payment for canes of different qualities, to be ground under different weather conditions, in mills of widely different efficiencies. Such a measure would be a clear encroachment on contractual freedom and would defeat all attempts towards improving the quality of the canes or the yield of the mills. On the other hand, one fails to see why a standard formula could not be used to determine the total value—in terms of the crystallizable sugar—of the cane delivered by the grower to the factory or to the middleman, leaving the distribution of this sugar to the free determination of the contracting parties.

Something similar has been done in Queensland. There the cane is reduced to terms of the sucrose in it that will make sugar. Both the content of fibre and impurities of the cane are taken into consideration. Profit sharing in this total available sugar would straighten out and standardize of itself, if, for nothing else, for the desirable uniformity in the semi-monthly liquidations. The settlement of this controversy in some such equitable way would do as much as anything else to restore the confidence necessary to enthusiastic teamwork.

Increased sensitiveness to the social responsibility involved in all deeds and policies that may affect the course of any great industry like ours, and the life of a whole community, will surely further the cause of equity, essential to welfare : a dynamic equity of three dimensions through the business, across to the people, and upwards in the realms of government.

Poland's Sugar Industry.

The sugar industry is one of the principal agricultural industries of Poland and it is also one of the oldest, for the first sugar factory was established as long ago as 1820. Like so many other industries, it suffered enormous losses during the war through destruction of buildings, plant and also capital. While in 1913-14 87 sugar factories were in full action, only 59 were struggling along in 1918-1919. The number of factories had increased to 72 by 1925-26 and this number has been maintained during the subsequent years. However, small factories have been liquidated as new, large and modern factories have become active, and to-day the Polish sugar factories are organized on a high level of efficiency. The capacity of individual factories varies from 3 to 30 thousand centals of beetroot per day and from 150 to 1,500 centals during the annual campaign.

With regard to sugar production, Poland occupies the fourth place after Germany, Czechoslovakia and France. Before the war sugar factories within the present territory of the Republic produced 567,000 tons. In the year immediately following the outbreak of war production fell to 152,000 tons, but increased rapidly with each succeeding year until it reached 820,000 tons in 1929-30.

The following table shows the development of production, home consumption and exports in thousands of tons calculated in values of white crystals :—

	Number of Factories.	Production of Sugar.	Home Consumption.	Exports.
1913-14	87	567	284	290
1914-15	63	152	109	43
1925-26	72	521	267	236
1926-27	70	501	309	205
1927-28	72	505	347	148
1928-29	71	685	369	284
1929-30	70	820	219*	365*

* During the first eight months ending May 31st, 1930.

It is clear from the above figures that parallelly with the production, the consumption of sugar has increased in Poland. Nevertheless, owing to the fact that 65 per cent. of the population is agricultural and is not a large consumer of this commodity, consumption in Poland is considerably lower than in other West European countries and during last year amounted only to 12 kgs. (26 lbs.) per head. However, in view of the steadily growing consumption, the Polish sugar industry has very good prospects for the future.

For the time being the industry is obliged to export large quantities of sugar, and at present Poland is one of the largest exporters of this commodity. Besides white sugar, i.e., crystals and refined sugar, Poland exports considerable quantities of raw sugar, as also certain by-products such as molasses and treacle. The main centres of sale for Polish sugar are London, Danzig, Hamburg, Riga and Tallin. The principal importers in Europe are Great Britain, Holland, Denmark, France, the Baltic and Scandinavian countries. Large quantities are also exported to Asia and Africa.

Last year the Polish Sugar Syndicate joined the Liverpool Sugar Exchange Ltd.

The industry is very well organized. All factories are federated into two territorial syndicates with a joint central body, the Executive Council of the Polish Sugar Industry. Commercially the factories form a cartel for the sale of sugar at home and abroad, as also for the financing of individual factories.

Milling Control Terms, and their Suitability for International Use.[1]

By C. SIJLMANS.

By the principal milling control terms is meant : Terms intended (I) to give a criterion of the effective (financial) results ; (II) to express the results in a more technical way ; and (III) to judge the working of the imbibition process.

I.—Effective Result.

This cannot be expressed in any other way than as pol. (sucrose) obtained in mixed juice, or lost in bagasse per cent, pol. (sucrose) in cane, i.e., *pol. (sucrose) extraction,* or 100 *minus pol. (sucrose) extraction.* The principal objection to these terms is that the undetermined losses during juice extraction influence them favourably. Another is that the figures are dependent on weighings, so that the risk of error is rather great. The term 100 *minus pol. (sucrose) extraction* has some advantages over the *pol. (sucrose) extraction,* in that the respective differences are proportionally larger, which loss figure allows direct comparison with the other losses per cent. pol. (sucrose) in cane. This term of 100 minus pol. (sucrose) extraction, therefore, should be grouped separately under "losses per cent. pol. (sucrose) in cane."

II.—Technical Results.

To this group belongs the *Milling Loss,* i.e., *pol. in bagasse per cent. fibre* in bagasse as per formula : 100 pol. per cent. bagasse/fibre per cent. bagasse. It is at present used in T.H., B.W.I., Mauritius, Natal, P.I., and P.R. ; and has the following advantages : (*a*) Great simplicity, needing only four figures determined directly, viz., pol. per cent. bagasse, moisture per cent. bagasse, Brix and pol. of last mill juice ; (*b*) quantities do not occur in the calculations, so that the figure is independent of incorrect weighings or measurements : and (*c*) it is not greatly affected by an incorrect purity of the l.m.j. On the other hand, the figure is considerably influenced by an error in the pol. bagasse, though its principal disadvantage is that it is influenced to an undesirable degree by the pol. per cent. cane, as the purity of the residual juice is in the first instance dependent on the purity of the normal juice. In Java it has been accepted as a fact for many years that the pol. in bagasse per cent fibre is not a good basis for mutual comparison, for the reason cited, namely, its dependence on the pol. per cent. cane.

A second term in this group is the *normal juice lost in bagasse per cent. fibre,* according to the formula : $\frac{(100-e)\ (100-f)}{f}$ in which $(100-e)$ = normal juice in last bagasse per cent. normal juice in cane ; $(100-f)$ = normal juice per cent. cane, and f = fibre per cent. cane.[2] In practice this term has the disadvantage that calculation of the Brix normal juice is necessary, this being rather lengthy, and requiring the weight of the bagasse ; in other words, the term is dependent on the weight of the cane, of the mixed juice, and of the imbibition water with all the shortcomings of the same. However, the influence of these factors on the figure is not great. On the other hand, the figure has the advantage that it is not "flattered" by undetermined losses due to inversion during extraction, as the decrease in pol. per cent. bagasse, and the decrease in purity of the last mill juice, eliminate each other. Its principal advantage lies in the logical line of thought underlying it :

[1] Paper (here abridged) published in the Proceedings of the Third (Java) Congress of the International Society of Sugar Cane Technologists.

[2] A similar term is the Lely ratio, used in Natal, which is based on pol. instead of Brix, but it needs no further explanation that the calculation with Brix is the better one.

namely, that the crushing plant combined with the imbibition process has to extract juice, whilst the fibre tries to retain it. So the residual juice in bagasse, undiluted, is to be considered as a real criterion of the effect obtained from this point of view.

A third term is the *undiluted juice lost in bagasse per cent. fibre* :—

$$\frac{10{,}000 \times \text{Brix bagasse}}{\text{Brix primary juice} \times \text{fibre per cent. bagasse,}}$$

which is one of the principal criteria in milling control in Java. Its only essential difference from the second term (just discussed above) is that instead of the Brix normal juice, the Brix primary juice is used. Advantages of this are : that quantities need not be known in the calculations, the figure thus being independent of incorrect weighings ; that, owing to this, factories can be included which for some reason cannot determine the weight of cane or added water ; that the calculations become very much simplified ; and that the Brix primary juice is a directly determined value, in contradistinction to the Brix normal juice, which must be calculated. This term *undiluted juice lost in bagasse per cent. fibre* is preferable to *normal juice lost in bagasse per cent. fibre* ; and it has been proposed for international use.

A fourth term is the *extraction ratio*, commonly used in Hawaii :—

$$\frac{100\ (100 - \text{pol. (sucrose) extraction})}{\text{Fibre per cent. cane.}}$$

As the pol. (sucrose) extraction and the fibre per cent. cane are always ascertained, this term requires little extra calculation. However, weights must be known, and thus the term is dependent on them, though in a considerably smaller measure than the pol. (sucrose) extraction, because error in weight, which also affects fibre per cent. cane, has been partly eliminated. A too high or too low pol. (sucrose) extraction caused by circumstances which have nothing to do with fibre per cent. cane result, however, in a too high or too low "loss figure," giving a wrong idea of reliability. Its application remains limited to those factories which are able to carry out the required weighings.

Concluding from the above examination, it appears that the term *Milling Loss* cannot be introduced into international use ; as for the other three, they have about the same value for purpose of international comparison. However, the term *undiluted juice lost in bagasse per cent. fibre* is the only one of the three which combines the main principles sought after, namely, sufficient accuracy for practical purposes, no lengthy calculation, general applicability, and a logical line of thought. It must be clearly understood that the *undiluted juice lost in bagasse per cent. fibre* is plainly a criterion of the milling result and not one of the milling efficiency. And one must keep in mind the conditions influencing the figure, namely : the number of mills, their power, the degree of preparation, the quantity of added water, and lastly the nature of the fibre.

III.—Imbibition Working.

Terms in this group express milling efficiency inclusive of imbibition, taking into account the number of mills and preferably the quantity of added water too. It will be clear that the nature of the fibre cannot be considered here. Under this heading there are two terms : (*a*) Deerr's *milling performance figure* ; and (*b*) the *residual ratio* used in Java. Both are based on the same principle, i.e., the quantity of residual juice (undiluted) in the last bagasse is compared with a fixed quantity, either "ideal" or "normal." In the system proposed by Deerr the ideal figure is calculated, taking into account the number of mills concerned in the secondary process and the

quantity of added water. With the residual ratio of Java the normal figure is fixed considering only the number of mills inclusive of preparatory machinery. Then COPP[1] has suggested a *coefficient of admixture* which equals imbibition water in the last bagasse per cent. juice in last bagasse ; and also a *maceration efficiency factor,* which equals the coefficient of admixture divided by the added water per cent. fibre. None of these terms, however, forms a satisfactory criterion for the imbibition effect.

A Method for the Analysis of Cane Milling Operations.[2]

By NOËL DEERR

At various times during the past quarter century, I have published articles dealing with the analysis of milling results, terminating in what I have called " The Algebraical Theory of the Extraction of Juice by Milling."[3] This theory postulates an ideal cane consisting of juice and fibre, each of these two constituents being of uniform constitution. This postulate of an ideal cane is far from the truth, and both treats as one the two different fibres—the parenchyma and sclerenchyma—and the different juices in the vascular system and pith cells, and equally neglects the presence of the constitutional water, or water of absorption.

It is the writer's object in this article to show that comparative results as between mill and mill, and valuable information for the running control of the operation of mills, can be obtained with neglect of consideration of these factors.

Primary and Secondary Processes.

The theory developed by the writer divides the operation of the extraction of juice into two phases—one represented by the expression of the undiluted juice and the other by the expression of diluted juice in the process of imbibition or maceration. The former of these operations is referred to as the primary process and the latter as the secondary process.

The theory developed by the writer merely gives the solution of the problem : "If a material consisting of f fibre and $(1-f)$ juice be crushed until it contains m fibre in a series of mills, with the addition of w water immediately before the final crushing and with the systematic return of dilute juice, what proportion of $(1-f)$ has been obtained in the primary and secondary processes ? " The solution appears below :—

Primary extraction $= (m-f) \,/\, [m\,(1-f)] = e_p$

$$\text{Secondary extraction} = \frac{(1-e_p) \times r\,[1-r)^n - r^n]}{(1-r)^{n+1} - r^{n+1}} = e_s.$$

The total extraction is the sum of these expressions. The value of r in the expression above is the value of the ratio $wm \,/\, (f + wm - fm)$ where w is the added water per unit of cane. If w be expressed in terms of f, putting $w/f = k$, this expression reduces to $km \,/\, [1 + (k-1)\,m]$ and finally, if m be put $= 0{\cdot}5$, it further reduces to $k \,/\, (1 + k)$.

The value of the terms containing r in the expression, the value of the secondary extraction, may be denoted by R_1, R_2, etc., the subscript referring to the value of n, or number of units employed in the secondary process.

[1] *Facts about Sugar*, 1928, 23, 350.
[2] Paper read before the Third Congress of the International Society of Sugar Cane Technologists, Java, and published in the Proceedings. [3] *I.S.J.*, 1928, 247.

These values of R have been calculated by the writer for values of n 1 to 5, for values of k $0{\cdot}5f$ to $3.0f$ and for a constant value of $m = 0{\cdot}5$. For convenience of reference these are reproduced below in Schedule I.

In what the writer terms the ideal case, certain very simple relations connecting the values of the various juices appear. These are, where B_p = Brix of primary juice, B_m = Brix of mixed juice, B_l = Brix of last juice, B_s = Brix of secondary juice :—

$B_m = B_p \times [(m - f)f + 0{\cdot}5R] / [(m - f)f + 0{\cdot}5k)$

$B_s = B_p \times R/k$

$B_l = B_p \times (1 - R)$.

It was at first hoped that all these ratios would aid in the control of operation of milling plants, but on consideration it will easily be seen that the second and third have but a limited application. An inefficient primary crushing will always result in a high value of the Brix in the secondary juice, and similarly it will almost invariably be found that the Brix of the last mill juice is always higher than the ideal value, due to imperfection of operation in the earlier mills of the train.

SCHEDULE I.

Values of the expression $\frac{r(1-r)^n - r^n}{(1-r)^{n+1} - r^{n+1}} = R_1, R_2,$ etc., where $r = \frac{wm}{f + wm - fm}$ for values of $m = 0{\cdot}5$, $w = f$ to $3f$ and $n = 1$ to 5.

W.	R_1.	R_2.	R_3.	R_4.	R_5.
0·5f	0·3333	0·4285	0·4667	0·4838	0·4920
0·6f	0·3750	0·4908	0·5404	0·5663	0·5803
0·7f	0·4118	0·5425	0·6057	0·6388	0·6600
0·8f	0·4444	0·5901	0·6611	0·7024	0·7289
0·9f	0·4737	0·6315	0·7086	0·7558	0·7869
1·0f	0·5000	0·6667	0·7500	0·8000	0·8333
1·1f	0·5238	0·6976	0·7846	0·8362	0·8709
1·2f	0·5454	0·7251	0·8136	0·8654	0·9042
1·3f	0·5652	0·7494	0·8383	0·8893	0·9217
1·4f	0·5833	0·7705	0·8592	0·9085	0·9385
1·5f	0·6000	0·7895	0·8769	0·9250	0·9518
1·6f	0·6154	0·8062	0·8916	0·9364	0·9620
1·7f	0·6296	0·8211	0·9047	0·9469	0·9696
1·8f	0·6429	0·8345	0·9158	0·9546	0·9756
1·9f	0·6552	0·8464	0·9252	0·9622	0·9804
2·0f	0·6667	0·8571	0·9333	0·9676	0·9841
2·1f	0·6774	0·8668	0·9404	0·9723	0·9870
2·2f	0·6875	0·8756	0·9464	0·9763	0·9893
2·3f	0·6970	0·8839	0·9518	0·9794	0·9913
2·4f	0·7059	0·8909	0·9561	0·9822	0·9927
2·5f	0·7143	0·8974	0·9606	0·9846	0·9938
2·6f	0·7722	0·9034	0·9642	0·9867	0·9949
2·7f	0·7297	0·9090	0·9673	0·9879	0·9956
2·8f	0·7368	0·9142	0·9701	0·9895	0·9963
2·9f	0·7436	0·9188	0·9727	0·9907	0·9969
3·0f	0·7500	0·9231	0·9750	0·9917	0·9974

COMPARISON OF THE ACTUAL AND IDEAL VALUES.

Comparison of the actual and ideal values of the Brix of mixed juice (B_{ma} and B_{mi}) is not, however, open to these objections. Provided that the bagasse from the secondary process is discharged with a value of $m = 0{\cdot}50$,

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59 WORKING IN JAVA

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the weight of mixed juice actually obtained is the same as in the ideal system though the proportions obtained in the primary and secondary processes may be diffeıent. It is then evident that the ratio B_{ma}/B_{mi} is connected with the milling efficiency as a whole and when the fibre in the secondary bagasse (m_s) has the value 0·5 accepted as standard in the ideal case, that the ratio is an exact measure of the operative efficiency. Correction for variation in value of m_s, may be easily made as shown later. This ratio with the correction as given below, the writer suggests, may conveniently be recorded as a routine observation and termed the "performance."[1] It is to be noted that the use of this term refers to the plant under the conditions of actual operation and includes the fibre, the added water, and the number of units in the train. It forms, therefore, also a basis for comparing the results obtained in different milling plants, with compensation for the influence of three important variables. It does not and cannot allow for differences in quantity of cane milled, or for the use of appliances such as cane knives or shredders, or for different mechanical devices used, in the application of added water and returned dilute juices. A means to demonstrate the effect of such variations is, however, afforded.

SCHEDULE II : INDIAN MILLS.

	11-roller		14-roller			17-roller
	1.	2.	3.	4.	5.	6.
f	0·1522	0·1579	0·1502	0·1321	0·1816	0·1629
w	0·2473	0·2884	0·2688	0·2891	0·2265	0·1804
k	1·6300	1·8100	1·7900	2·1900	1·4800	1·1000
R	0·8107	0·8347	0·9147	0·9458	0·8734	0·8362
B_p	0·1727	0·1660	0·1716	0·1740	0·1856	0·1800
B_{ma}	0·1386	0·1266	0·1359	0·1347	0·1569	0·1615
B_{sa}	——	0·0796	0·0984	0·1089	0·1298	0·1451
B_{ia}	0·0554	0·0479	0·0435	0·0428	0·0468	0·0497
B_{mi}	0·1499	0·1406	0·1483	0·1461	0·1632	0·1709
B_{si}	0·0859	0·0765	0·0877	0·0751	0·1095	0·1368
B_{ii}	0·0327	0·0274	0·0146	0·0094	0·0235	0·0295
J_m	0·9186	0·9612	0·9508	1·0182	0·8701	0·8519
m_p	——	0·3372	0·2928	0·2215	0·3356	0·2715
m_s	0·4630	0·4856	0·4723	0·4876	0·5095	0·4959
B_{mac}	0·1344	0·1254	0·1334	0·1338	0·1581	0·1610
P	0·8967	0·8919	0·8995	0·9158	0·9688	0·9421
e	0·9091	0·9050	0·9190	0·9387	0·9271	0·9435
$\frac{(1-e)/f}{1-f}$	0·5063	0·5066	0·4588	0·4027	0·3285	0·2903
Ton-fibre-hour per lineal inch of roller	0·4500	0·5500	0·4200	0·4700	0·6400	0·7100

It will only exceptionally occur that the value of m_{sa} is exactly 0·5 and it is in these cases necessary to apply a correction to the value of B_{ma} which will be increased when m_{sa} is greater than 0·5 and decreased when m_{sa} is less than 0·5. The derivation of the correction is :—Let *Jm* = weight of mixed juice, and m_{sa} be fibre in secondary bagasse. Then weight of the mixed juice when $m_{sa} = 0·5$ is $J_m + (f/0·5 - f/m_{sa})$ and the corrected value of B_{ma} (B_{mac}) is :—$B_{ma} \times J_m / [J_m \, (f/·5 - f/m_{sa})]$.

[1] I originally used the term "mechanical efficiency factor" and then "operative efficiency factor." Objection might be made to these terms if referred to a plant operating at high capacity with a low extraction. Such a plant might be mechanically efficient and operating satisfactorily. The use of the term "performance" does not cast any reflection on such a combination.

It will be apparent on consideration that the value of the expression B_{mac}/B_{mi} is nothing more than the ratio of the actual extraction on a Brix basis to the ideal extraction, and this comes very close to the ratio of the "normal" juice extraction to the ideal extraction. It may appear that I have gone a long way round to obtain this result, but the development of the reasoning may not be without its value.

CALCULATIONS INVOLVED.

It is not customary in routine control to observe the Brix of the secondary juice (B_s). This observation should be of value, for when combined with values of B_p and B_m, the quantity of both primary and secondary juice can be obtained and when that of the former is known, the fibre in the primary bagasse (m_p) follows by an easy calculation. The calculations involved are: Primary juice per unit mixed juice $= (B_m - B_s) / (B_p - B_s) = J_p/J_m$. Primary juice per unit cane $(J_p/J_m) \times J_m = J_p$. Fibre per unit primary bagasse $= f / (1 - J_p) = m_p$.

The efficiency of the primary crushing has a very material effect on the extraction as a whole, and as the value of m_p is a measure of this, it would appear that a knowledge of the value of m_p is of value in the control. The writer has not gone into the question of the comparative values of direct determination as opposed to the inferential determination, but would favour the latter method, not only on the score of convenience but of exactitude, since one determination based on easily controlled sampling of juice would cover a whole day's operation.

APPLICATION TO MILLING PLANTS.

The application of this means of analysis to plants—under the writer's administration—is discussed below. The plants consisted of one 17-roller, three 14-roller and two 11-roller plants. Those numbered 1, 2, 3, 5 and 6 were all 28 in. × 56 in.; No. 4 was 20 in. × 36 in. All mills except the first two in No. 5 were under hydraulic control, the load on the top roller being about 160 tons in the 56 in. mills and about 100 tons in the 36 in. mill. The first two mills in plant No. 5 were provided with toggles. Plant No. 5 operated almost exclusively on hybrid canes of the Coimbatore series; plants Nos. 1, 2, 3, 6 on varying proportions of Coimbatore and an Indian variety, Hemza, belonging to BARBER'S Mungo series; plant No. 4 milled almost exclusively Hemza cane. The crushers in each case consisted of "splitter" rolls with deep circumferential grooving. All mills were provided with Messchaert grooving and in each of the plants 3 and 6, two Meinecke chutes were installed.

The actual and ideal results of these six plants are set out in Schedule II, and from a study of these results the following remarks are in order :—

1. The primary crushing falls far short of the standard accepted as ideal and consequently a greater importance becomes attached to the secondary process. Plants 2 and 5 may be possibly, in the absence of other criteria, considered satisfactory, with plant 4 unsatisfactory. Plant 2, however, has given a very low performance and evidently attention is required to the secondary process. Plant 5, which has an exceptionally high performance, must also have operated satisfactorily in the secondary process.

2. Plant 6, which represents the only 17-roller combination, has also done well and its extraction demonstrates the advantage of a long train when dealing with high fibre canes and also demonstrates the advantage obtainable in the scope for the reduction of added water.

3. The comparison between plants 1, 2 and 3 is of interest. All worked under conditions of fibre and added water not far apart and though there is considerable difference in the observed extraction, the performances are not very different.

SCHEDULE III : JAVA MILLS.

11-ROLLER

f	0·1400	0·1190	0·1280	0·1200	0·1140
w	0·1850	0·2000	0·1570	0·1440	0·1460
k	1·2200	1·6800	1·2300	1·2000	1·2800
R	0·7536	0·8181	0·7324	0·7251	0·7445
B_{pa}	0·1940	0·1840	0·1680	0·1920	0·1960
B_{ma}*	0·1620	0·1520	0·1430	0·1670	0·1660
B_{mi}	0·1770	0·1640	0·1540	0·1780	0·1830
P	0·9193	0·9246	0·9161	0·9285	0·9060
e	0·9220	0·9350	0·9360	0·9280	0·9360

14-ROLLER.

f	0·1250	0·1130	0·1230	0·1310	0·1160
w	0·1580	0·1580	0·2000	0·1980	0·1690
k	1·2600	1·4000	1·6300	1·5100	1·4600
R	0·8284	0·8592	0·9036	0·8783	0·8708
B_{pa}	0·1810	0·1810	0·1740	0·1760	0·1920
B_{ma}*	0·1590	0·1560	0·1470	0·1500	0·1680
B_{mi}	0·1700	0·1690	0·1570	0·1600	0·1870
P	0·9360	0·9223	0·9330	0·9349	0·9442
e	0·9440	0·9530	0·9630	0·9440	0·9600

17-ROLLER.

f	0·1260	0·1290	0·1260	0·1220	0·1150
w	0·1880	0·2000	0·2400	0·2000	0·2020
k	1·4900	1·5500	1·9100	1·6400	1·7600
R	0·9234	0·9305	0·9627	0·9401	0·9555
B_{pa}	0·1900	0·2020	0·1850	0·1740	0·1850
B_{ma}*	0·1640	0·1780	0·1510	0·1470	0·1560
B_{mi}	0·1760	0·1940	0·1720	0·1580	0·1720
P	0·9345	0·9633	0·9282	0·9217	0·9322
e	0·9520	0·9730	0·9680	0·9630	0·9630

* Not corrected for value of m_s

SCHEDULE IV : HAWAIIAN MILLS.

	11-roller.		14-roller.			17-roller.
	1.	2.	3.	4.	5.	6.
f	0·1288	0·1374	0·1296	0·1289	0·1255	0·1172
w	0·2816	0·3478	0·3191	0·3498	0·3351	0·3114
k	2·1900	2·5200	2·4500	2·7100	2·6700	2·6700
R	0·8747	0·8986	0·9584	0·9680	0·9664	0·9758
B_p	0·1797	0·1961	0·1913	0·1899	0·1935	0·1834
B_{ma}	0·1322	0·1403	0·1455	0·1404	0·1470	0·1415
B_{mac}	0·1356	0·1450	1·1494	0·1440	0·1514	0·1463
B_{mi}	0·1501	0·1483	0·1563	0·1508	0·1551	0·1498
P	0·9043	0·9335	0·9586	0·9547	0·9871	0·9765
M_s	0·5578	0·5749	0·5630	0·5600	0·5725	0·5936
e	0·9607	0·9716	0·9751	0·9717	0·9756	0·9845

4. Although these results are, the writer believes, comparable with others of record, they show how imperfect a process is the milling of cane. That high recoveries are obtained is mainly due to the dominant effect of the

primary crushing in which parenchyma juice of much higher value than that of the vascular system is mainly expressed.

As the results tabulated in Schedule II refer to mills operating under somewhat pecular conditions, especially with reference to the high fibre content, I give in Schedules III and IV similar calculations made for results of record of recent date for mills in Java and Hawaii and regret that I have none available from Cuba and other centres of the cane sugar industry.

Finally I wish to point out that the scheme of control now put forward abandons the "milling factor" originally proposed by the writer,[1] and to which he gave the value 0·975. In the resumé of opinions on control prepared by Mr. ZERBAN appears the following remark by Mr. S. S. PECK : "Your committee should strive for three main objectives, namely, accuracy, clarity and simplicity ; and of these three I consider the last as important as the first two. In striving for greater accuracy, formulas have become so complex that they are practically useless. If the committee stress simplicity of statement which will not conflict with accuracy and clarity, they may be able to do some persuading to an agreement on terms."

It is the writer's hope that these postulates are met by the present scheme, and I would finally remark that, though the fundamental equation appears complicated, when once values of R_1, R_2, etc., have been tabulated, the ciphering required is reduced to an almost negligible quantity.

*** At the Java Conference some considerable criticism was directed against the method presented in this article, mainly on the ground of its complex nature and of its too "theoretical" aspect. Mr. DEERR, while admitting that the development of the fundamental equation requires certain algebraic agility, remains of the opinion that when once the values of R_1, R_2, etc., have been tabulated, the simplicity demanded by Mr. PECK is obtained. Later we expect to publish a further article on the matter by Mr. DEERR.

"FLOODLIGHTS."—A recent advertisement in an American contemporary describes a searchlight on a mast in a sugar factory yard, stating that "C.-E Novalux floodlighting for mill yards provides brilliant illumination, so that milling operation may go on as efficiently at night as during the daylight hours ; it eliminates the danger of personal injuries, or of damage to rolling stock and equipment ; it makes possible continuous operation of the mill without loss of time."

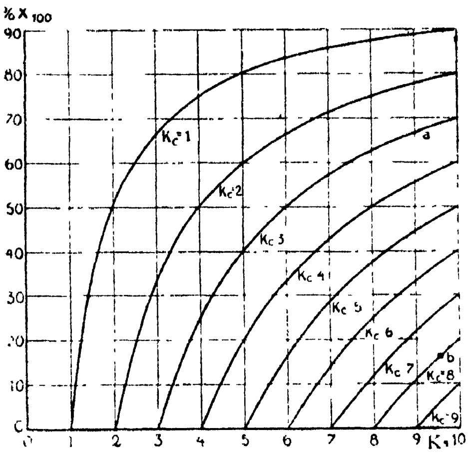
SUGAR ANALYSIS COMMISSION.—At the Java meeting last year of the International Congress of Sugar Cane Technologists, Dr. Honig proposed that "this meeting adopt a resolution to the effect that an International Sugar Commission should be instituted as it is a generally long felt want to specify uniform methods for sugar and sugar products." The last session was held in 1912, and attempts made since the war to resume the sessions have failed heretofore. Arrangements, however, are now being made for a sitting of the Congress in Amsterdam in August of next year.

LAMONT PROCESS.—At the recent International Exhibition held at Seville, Spain, a diploma was awarded to the splendid pilé (*granfino*) sugar, made by José Rufino & Co., of Recife. This sugar, quite the equal of any mainland refined product, was made at the Usina Ribeirao, Pernambuco, by Mr. N. E. Lamont, a Greenock sugarman, supervising chemist to the Cia. Geral de Melhoramentos de Pernambuco. This company is now erecting another refinery, the plant for which has been installed by Messrs. George Fletcher & Co., Ltd., of Derby. It also will employ the "Process Lamont," as it is known locally.

1 Haw. Sug. Exp. Stat. Bull. 30, Agric. and Chem. Series.

Beet Factory Technical Notes.

Ash Yield Formulae.—There is a considerable literature on means of calculating the possible yield of sugar from different strikes in pans or crystallizers; one can mention only the formulae of HULLA-SUCHOMEL, SCHNEIDER, and NEUMANN, using polarization, dry substance and purity values. Disadvantages of such formulae, however, are their insufficient accuracy, both the sucrose and dry substance determinations being subject to error in the case of syrups and molasses. Further, the time demanded by such analyses must be considered. But according to investigations by K. SANDERA[1] much better use can be made of formulae based on the determination of ash electrometrically, which can be carried out quickly and with sufficient precision. Further, in successive strikes there is a greater difference in the ash content than there is in the case of the pol; for example, if from a second product massecuite having an ash content of 5 per cent. there crystallizes 50 per cent. of sugar, then the ash content rises to 10 per cent., that is a 100 per cent. increase, whereas the pol. only falls 27 per cent. Such ash yield formulae are based on simple calculation. If K is the ash, P the pol., and S the dry substance; and if the index letters c, v, and s denote massecuite, sugar and syrup respectively, then for undiluted syrups and massecuites the percentage of sugar (of 100 per cent. purity) crystallizing out is :—



$K_{100} = 100\,\dfrac{K_s - K_c}{K_s}$; while in the case of raw sugar of ash content K_v it becomes: $100\,\dfrac{K_s - K_c}{K_s - K_v}$. But in practice when the massecuites in the crystallizers are mixed not only with water but also with molasses, one uses the formula: $X_{100} = 100\,\dfrac{K_sP_c - K_cP_s}{K_sP_c}$; or for raw sugar $X_v = 100\,\dfrac{K_sP_c - K_cP_s}{P_sK_v - P_vK_s}$; though for this last formula can simplify to the following without any great error: $X_v = X_{100}\,\dfrac{100}{2P_v - 100}$. In the diagram here reproduced the application of the method is shown graphically, the abscissæ being the sugar per cent. (K_{100}), and the ordinates the ash content of the run-off or syrup (K_s), the curves denoting: $X_{100} = \dfrac{K_s - K_c}{K_s} \times 100$, K_c being constant for the several curves. Such curves form a picture of progressive crystallization from the same massecuite of an ash content K_c. Thus curve $K_c = 3$ may denote the separation of sugar from the first massecuite, and $K_c = 7$ to 9 the crystallization of the after-products, nothing being added

[1] *Zeitsch. Zuckerind. Czecho-slov.*, 1930, **54**, No. 38, 361-364.

to the massecuite or taken from it. As can be seen from the diagram, an accuracy of 0·5 from first and 1·0 per cent. from second products can be obtained from such formulae. In carrying out the determination, one strains by suction or centrifuges an average sample of massecuite ; one also weighs out 1·35 grm. of the original massecuite, dissolves in water and makes up to 100 c.c. Then the electrical conductivity of the syrup which has been strained or centrifuged from the massecuite, as well as that of the solution of massecuite, is determined, the values of K_s and K_c sufficing for the calculation being thus found. In using the diagram, one ascertained the intersection of the appropriate K_c curve with K_s, finding the corresponding X_{100} along the abscissae. For example, a massecuite having the composition, $S = 94$, pol. $= 72$, purity $= 75{\cdot}6$, gave a run-off having $S = 89{\cdot}8$, pol. $=$ 57, and purity $= 63{\cdot}9$; while the electrical conductivity values for the massecuite and run-off solutions were K_c and K_s 64 and 95 ; that is, ashes of 6·4 and 9·5, from which one calculates as follows :—$X_{100} = 100 \dfrac{95 - 64}{95} =$ 32·6 per cent. of pure sugar ; whilst the result for sugar of $P_v = 94$ becomes :

$$X_v = 32{\cdot}6 \frac{100}{188 - 100} = 37 \text{ per cent.}$$

Evaporator Scale. A close study has been made of the composition of beet factory evaporator deposits by E. SAILLARD,[1] Chemist of the Syndicate Laboratory, Paris, with his usual thoroughness. Samples were collected from no fewer than 23 beet sugar factories in France, and altogether 93 analyses were made. Tabulated results are promised later. In the meantime, he makes general observations regarding the figures obtained, of which the following is a summary : Oxalic acid and oxalates were found in surprisingly high amount, e.g., in the last body of the evaporator of Factory 21 no less than 45·55 per cent. of oxalic acid, equivalent to 80·62 per cent. of calcium oxalate, was present. On the other hand, scale from Factory 23, also from the last body, contained no oxalate at all ; but as much as 64 per cent. of silica and 10·65 per cent. of iron and alumina. In explanation of such extreme results, it is suggested that where no oxalate was present this was a scale from an evaporator which had been recently cleaned out by prolonged boiling with fairly strong acid. Silica (silicic acid) is generally present more in the first than in the last body. Thus the first body of Factory 16 contained 35 per cent. and the last 8·6 per cent. Sulphates were found in all samples, and sulphites in some, at times in quite high amount. Carbonates theoretically should hardly be present, but actually they were found in pre-evaporators and first bodies, and are accounted for no doubt by the formation of bicarbonates during the final carbonatation, the juice not having been boiled, or having been insufficiently boiled previous to entering the evaporators. Iron and aluminium oxides generally diminish from pre-evaporator to final body. Thus in the pre-evaporator of Factory 5, as much as 69 per cent. of iron and aluminium oxides was present, and only 1·84 per cent. in the last. Magnesium salts were generally found only in small proportions. Lastly, it is pointed out that the factors controlling the composition of beet factory scale are : The composition of the limestone, and especially the temperature used in the lime kilns ; the optimum alkalinity of the juice before it is boiled ; its proper boiling ; and the regularity of the working of the evaporator. It must also be remembered that if the scale

[1] *Supplement Circ. hebd.*, No. 2157 of 1930.

is taken from an evaporator which has recently been cleaned out with soda or acid or soda and acid, its composition will be much modified. Properly, rods of metal should be suspended on the interior of the evaporator tubes, and these rods withdrawn before cleaning, the scale collected on them being used for the average sample.

Lime Salts Determination. Almost generally for titrating the lime salts in factory juices, etc., one uses an alcoholic solution of potassium oleate (Castile soap), but a disadvantage is that often the end-point is slowly reached, especially when the lime salts are high. According to Dr. K. SOLON,[1] a more rapid procedure is that in which the titration is made with a solution of potassium palmitate after adding a few drops of phenolphthalein, the end-point being recognized by the reddening of the liquid, due to the hydrolysis of the potassium palmitate as soon as a drop in excess is added. On dissolving 26·5 grm. of purest palmitic acid in a mixture of 500 c.c of 95 per cent. alcohol and 300 c.c. of water, phenolphthalein added; and, while heating on a water-bath, a solution containing 7-8 grms. of potash in 50 c.c. of warm alcohol is added till the liquid reddens, the solution being finally cooled, and made up to 1000 c.c. One standardizes this against a solution containing 0·523 grm. of barium chloride per litre, 12·05 c.c. of which will be required for 100 c.c. of the palmitate solution for an N/28 solution. In order to recognize the reddening indicating the end-point, one must dilute as follows: First carbs., 10 c.c. to 100 c.c.; second carbs., 20 c.c. to 100 c.c.; syrups, 10 c.c. to 100 c.c., using recently-boiled distilled water with a *pH* not less than 6·3. This addition of water means that an excess of the palmitic solution must be used to obtain a perceptible red colour, the deduction made being usually 0·8 c.c. Example: 20 c.c. of juice were diluted with 100 c.c. of water, phenolphthalein added, and the liquid neutralized with N/28 HCl; after adding more phenolphthalein, the N/28 palmitate solution was added until a red colour again appeared, this requiring 2·0 c.c. Then 2·0 — 0·8 = 1·2 for 20 c.c., or 6·0 for 100 c.c., or 0·006 grm. CaO. A satisfactory agreement was shown between this method and that in which the lime was precipitated as oxalate, and titrated with permanganate.

Lime-kiln Control. K. SMOLENSKI and W. REICHER,[2] of the Central Laboratory of the Polish Sugar Industry, Warsaw, describe an instance of the irregular working of a lime-kiln which they were recently called upon to investigate. During a certain period of the working of the kiln, the analysis of the gases showed: CO_2, 15·6; CO, 19·7; and O_2, 1·0 per cent. Using these figures, the authors calculated the quantity of coke which had been burnt during the period of time in question per 100 kg. of limestone. It was found that the amount was 32·5 kg., according to which figure the "coefficient of insufficiency of air" was 0·66. By reducing the quantity of coke to 12 per cent., it was possible after some time to regulate the working of the kiln. Commenting on this particular case, the authors emphasize that the complete analysis of lime-kiln gases (CO_2, CO, and O_2) is capable of tendering great service even when the operation of the kiln is normal; but in the case of any anomaly whatever this analysis becomes quite indispensable. Secondly, they point out that from the complete and precise analysis of the gases. one can calculate the following data, enabling one to follow the working of the kiln: (*a*) The coefficient of excess or of insufficiency of air; and (*b*) the quantity

1 *Deut. Zuckerind.*, 1930, **55**, No. 17, 457-458.

2 "Prace Centralnego Laboratorjum Cukrowniczego w Latach, 1926-27." (Published by the Central Laboratory of the Polish Sugar Industry, Warsaw). Pages 231-235.

of coke consumed per 100 kg. of $CaCO_3$ decomposed. Lastly, they insist that the amount of coke employed for the calcination of the limestone should be determined exactly and controlled from time to time. It is most essential that the right proportions of coke and of limestone should be used with every charge.

MISCELLANEOUS.

Filter-cloth.—Br. NOWAKOWSKI, a Polish sugar technologist, points out the importance of trying different kinds of filter-cloth until one arrives at a material which both gives good results in filtration and is at the same time economical. He recommends jute as being generally satisfactory, but the efficiency of clarification considerably affects the amount used. The filtering surface of the first carbonatation process is about 51·4 sq. m. (554 sq ft), of the second carbonatation presses, 21·9 sq. m. (236 sq. ft.), and of the mechanical filters, 77·9 sq. m. (839 sq. ft.) per 100 metric tons of roots. *Fibrous beets.*[1]—Such roots slice with some difficulty due to the fact that the tissue surrounding the vascular bundles is lignified and hard, having thick walls. Prof. K. SMOLENSKI and H. TERASZKIEWICZ[2] point out that while their content in mark and actual fibre may be considerably higher than with normal beets, their sugar content is generally about the same. A premature development of the mother-beet in its first year of vegetation is the cause of lignification, which is probably hereditary. A more careful and exact selection from this point of view therefore appears to be the means of elimination indicated. *Knife holder.*—A new type of knife holder (model 1923 of AUG. PASCHEN, patented) is described by K. SMOLENSKI,[3] and is said to be advantageous in producing uniform and smooth cossettes, free form debris, and unbroken. A greater output from the machine can be obtained compared with ordinary holders, and removal of the knives is easy, certain and quick. *Dextran fermentation*—Sugar which had caked into large lumps in a Polish factory was found to contain dextran by K. SMOLENSKI and H. TERASZKIEWICZ,[4] a mass of gum being also collected from the cloths of the filter-presses of the same factory. Leuconostoc fermentation was proved to be active in the diffusion juices, the source of infection being traced to the water used for transporting the roots and for supplying the diffusion battery. The dextran which had been formed had been carried as far as the vacuum pans, having passed into the masse-cuites, and ultimately causing the caking of the sugar, as above described. *Subduing Froth.*—A study has been made by VL. STANEK and J. VONDRAK, of the Experiment Station, Prague, on the use of fats for the suppression of the froth arising in carbonatation.[5] They showed that emulsified rape oil is advantageous when the frothing is moderate, but that when it is very troublesome it is better to use the straight oil. Tallow, coconut oil, bone grease, and lanoline, however, appear to be preferable to rape oil on the whole, though this conclusion cannot be generalized. *Ash : Non-Ratio for Raw Beet Sugars.* Dr. ROSÉE. *Die deutsche Zuckerindustrie*, 1929, **54**, 1144. In discussing the composition of raw beet sugars as revealed by commercial analyses of the past few years, the author comments on the ratio of 1 part of ash to non-sugar, this having varied from 1·45 to 1·84 during the years from 1922-23 to 1928-29 : whereas for 1929-30 it was a shigh as 2·05. This variation is due to the varying mineral composition of the beet, which emphasises the importance of ash conductivity determinations for the raw juices and onwards.

1 "Prace Centralengo Laboratorjum Cukrowihczego w Latack, 1926-27," pages 266-273.
2 *Ibid.* Pages 318-336. 3 *Ibid.*, 337-339. 4 *Ibid.*, pages 365-378.
5 *Zeitsch. Zuckerind. Czechoslov.*, 1930, **54**, No. 33, 353-360.

Publications Received.

Principles of Soil Technology. By Paul Emerson, Ph.D., Associate Professor of Soils, Iowa State College. (Macmillan & Co., Ltd., London). 1930. Price : 14s.

Though written for the American student, and illustrated largely by reference to the soil areas of the United States, this book well correlates the facts of soil knowledge in a fundamental manner, the author recognizing that in order to understand as fully as they can be comprehended the complex factors governing soil management and soil productivity, it is first necessary that the principle of the soil as applied to the soil *in situ* should be grasped. Part I deals with the properties and functions of the soil ; soil formation ; soil genesis ; soil morphology ; soil classification ; and soil areas of the United States. Part II with the physical formation of soil, soil texture ; soil colloids ; soil air ; soil temperature ; soil water ; physical properties of the soil mass ; and physical properties and plant growth. Part III with soil composition : the chemical properties of soils ; soil reaction and *pH* ; the soil solution ; the chemical and physical properties of soils in relation to plant growth. Part IV treats of soil life ; the function of the micro-organic soil population : factors influencing the biological functions in soils ; and soil cycles. There are several pages of soil charts and tables giving chemical and mechanical compositions of soils ; and a glossary of terms.

The Documents in the Case. Dorothy L. Sayers and Robert Eustace. (Ernest Benn, Ltd., London). 1930. Price : 7s. 6d.

A work of fiction is seldom noticed in these columns ; but we would like to draw attention to this absorbing story, in which, probably for the first time in romance, the polariscope figures as the means of detecting the criminal. A verdict of accidental death has been returned in the case of a man who has succumbed after partaking of a dish of mushrooms. Most exciting is the scene later in a laboratory, in which a polariscopic investigation, very accurately described, reveals the fact that the murderer had employed the novel idea of doping the apparently harmless mushrooms with synthetic muscarine, the most dangerous alkaloid to be found in toxic fungi. How the victim is proved to have been poisoned with the optically-inactive synthetic compound, and not with optically-active natural muscarine (such as may be present in toadstools), is worked out convincingly. In this way the verdict of accidental death is reversed, and the actual murderer is hanged. Stories of this kind are generally much lacking in the accuracy of their scientific treatment ; but not so in "The Documents in the Case." Its scientific description will tax the critical powers of most chemists. Its plot is particularly skilful, its characterization vivid ; and its dialogue (the story is told in a series of letters by the different parties concerned) is certainly bright and very modern.

Technologie der Rohsaftgewinnung der Zuckerfabrikation. (Technology of the Production of Raw Juice in Sugar Manufacture). Ferdinand Kryz. (A. Hartleben's Verlag, Leipzig). 1930.

This small book may be said to be unique, inasmuch as it is the first to be published dealing separately with the juice extraction stage of beet sugar manufacture. It is a practical and theoretical manual for the manager and chemist, collecting as it does what is worth while in the operation of the diffusion process and on the chemical and physical processes that occur. It is particularly good on the control side, giving a good deal of space to methods for testing the working of the battery, including means for following the behaviour of separate cells, as the Battut and Sokolow curves, and the electrical conductivity curves recently put forward by SANDERA. Analytical processes are not discussed exhaustively, reference being made for these to the same author's handy book on this subject.[1] Some special apparatus is described, viz., the VOLQUARTZ and RAABE density meters, both very satisfactory apparatus, and the RASSMUS recording device, which automatically registers the diffusers drawn off, the amount of juice obtained, and the time taken for each draft. KRYZ' book is also very

[1] *I.S.J.*, 1928, 663.

useful for the information it gives regarding the newer extraction processes, the "Rapid" in particular, as well as for its chapter on calculations involved in the process of extraction, which gives several figures which should be very useful in practice.

Sugar Affining. M. I. Nachmanowitsch and S. L. Bermann. Monographs on the Sugar Industry. (In Russian). (Ukrainian Sugar Experiment Station, Kiev, U.S.S.R.). 1930.

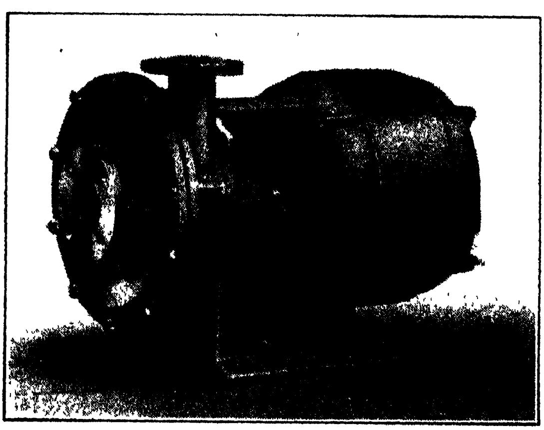
This small book of 143 pages gives a general summary of known information on the practice and control of the affination stage of sugar refining. Plant and accessories are well described and illustrated. It mentions an apparatus in which spinning, washing and solution of the crystals are carried out in the one continuously-operating unit, the centrigugal of which resembles the DIX machine, except that it is provided with a perforate as well as with an imperforate drum. Methods for the examination of raw sugars for their affinability value are given, and some account of up-to-date control methods; those, for example, in which the washed crystals are compared with samples standardized by spectrophotometric measurements, and in which the filtrability of liquors is estimated by an ultrafiltration test or by the dye value.

A Study of the Structure of Sugar Beets in Relation to Sugar Contents and Type. Ernst Artschwager. Reprint G-724; Journal of Agricultural Research, 1930, 40, No. 10, 867-914.

Contents: Ring number and density; innermost ring; central core; vascular ring; environment and anatomical structure; and relation of structure to percentage of sucrose and type purity.

Olivite Acid Pumps.

The Oliver-United Filters, Inc., of San Francisco, have lately devised a centrifugal pump for use with corrosive liquids which will withstand resulting destructive action over long periods and at the same time combine rugged construction with high hydraulic efficiency. Their Olivite acid pumps claim to have eliminated the undesirable qualities inherent in lead, bronze, porcelain, stoneware and hard rubber pumps. The procedure consists in acid proofing the casing and impeller with a preparation (Olivite) which claims to have all the chemical resistant qualities of hard rubber, but has relatively high tensile strength, does not crack, and withstands comparatively high temperatures. These pumps are made in 1¼ and 2 in. sizes, covering a range of capacities from 10 to 200 gallons per minute, the maximum head of the smaller size being 60 feet; and the pumps are designed both for motor and for belt drive.



1¼ IN. OLIVITE PUMP. MOTOR DRIVE.

Brevities.

COMPOUND CLARIFICATION.—The Petree-Dorr patented process of compound clarification produces a clarified juice, not only brilliant, but also singularly free from colloids. Advantages of compound clarification may be summarized as follows: 1-2 per cent. increase in recovery; saving in labour, in fuel, and space; a continuous stream of brilliant juice; reduction of load on filter-presses by 50 to 70 per cent.; increased efficiency of vacuum pans and evaporators; quicker curing of sugars in the centrifugals; and lastly cleaner and drier sugars.[1]

VALUE OF PHOSPHORIC ACID.—"Under observations on factory work, reference is made to the poor clarification of juice obtained in the majority of the factories visited (in British Guiana). Turbidity of clarified juice, where correct heating and liming are carried out, has been found to be in large measure due to lack of phosphoric acid in the juice, pointing to deficiency of phosphoric acid in the soil...... At two factories where phosphoric acid was being added continuously to the juice during clarification a brilliantly clear clarified juice was obtained."[2]

SAND BLAST.—J. E. Bihl recommends[3] the use of the sand blast for cleaning machinery during the off-crop, viz., pipes, tanks, and ironwork generally, also for brass work, though for such material fine river sand which has been passed through a sieve is best. Whereas formerly it took one man 2½ days to chip and scrape a 30 in. centrifugal basket, with the use of the sand blast two men were able to clean five baskets in one day. It is necessary to provide the workmen with masks. Unfortunately the method cannot be applied to the cleaning of long tubes as in evaporators and juice-heaters.

GEORGE FLETCHER & CO., LTD., of DERBY.—We are informed by Messrs. George Fletcher & Co. Ltd., that owing to temporary financial embarrassment, due to delay in payment of certain outstanding debts from overseas customers, a Receiver and Manager has been appointed to ensure the continuance of the business. The Receiver has obtained adequate financial support to carry on, and he anticipates that his appointment will be for a short time only. With the aid of the Company's Directors and Staff the Company's activities will be continued as in the past, and all orders for sugar machinery will be promptly executed.

ELECTRIC GAS TESTERS.—Electrically operated apparatus is now being sold, claimed to be entirely reliable and very rapid in indication, by means of which the percentage of CO_2 and CO present in a flue gas can be read on dials with very little manipulation. The CO_2 is determined by the heat conductivity of the gases caused to flow around a wire spiral, the variations in the resistance of which are measured by a bridge system. In the case of the CO determination, temperature variation is brought about by the catalytic combustion of the CO with hydrogen, the electric resistance of a wire varying consequently in proportion to the amount of carbon monoxide present.

BRITISH SUGAR BEET.—An increase in Great Britain of 117,600 acres (51 per cent.) in the area under sugar beet has brought the acreage to 348,100 acres, as compared with 230,500 last year. Except for trifling decreases in three northern counties and one in Wales, increases were general throughout the country. The bulk of the increase was shown in the Eastern and North Eastern divisions which between them returned 93,000 acres more than in 1929. The largest county increases were 28,000 acres in Lincolnshire; 21,000 acres in Norfolk; 13,000 acres in Suffolk; and 12,000 acres in the Isle of Ely. Outside these two divisions the most important increase was that of 5000 acres in Salop.

BEET WORKERS WELFARE—Reports from H.M. Inspectors of Factories (in the United Kingdom) have shown that there is need for special provision for the welfare of workers employed in sugar factories, and the Home Secretary proposes in pursuance of the powers conferred on him to make a Welfare order. A draft of this order has been issued to the sugar factories, and objections to it will be considered by the Home Office. It provides among other things for suitable messroom and washing facilities, and also that the official cautionary notice as to the prevention and cure of dermatitis (cases of which have been reported) shall be prominently brought to the notice of the workers.

1 Data from a recent advertisement.
2 *Report of the West Indian Sugar Commission*, 1930, page 93.
3 *Proceedings of the Annual Congress, S.A. Sugar Technologists' Association*, 1929.

Review of Current Technical Literature.[1]

FILTRATION INVESTIGATIONS IN NATAL (USING FILTER-PRESSES, DOUBLE PRESSING AND ROTARY FILTERS). **W. H. Foster.** *Proceedings of the Annual General Meeting and Congress, South African Sugar Technologists' Association*, **1929.**

Sugar lost in filter-cakes of Natal factories, 2 per cent. on the sugar entering the factory, is an indication of the very refractory nature of the product handled. Higher dilution of the settlings does not appear economical, as few Natal factories appear to have a superfluity of steam, subsiding tank or filter capacity. Washing the cake in the press in the usual way gives indifferent results and at times is impracticable. By introducing the wash-water through the feed line to the press without interrupting the continuity of flow, better results have been recorded but the resultant cake is usually wet and sloppy, an undesirable feature as regards transport facilities. This further means a multiplicity of pumps. Double filtration has been given an extended trial. The reduction of the sucrose content of the cake appears quite satisfactory though the recovery of sucrose has been accompanied by the extraction of a considerable amount of impurities as is evidenced by the depression of the purity quotient of the second filtrate. This led to the abandonment of the process for the time being.

Dilution and decantation of the settlings had, therefore, to be accepted as the standard procedure, the separation of the juices as in the Petree process being retained, the muds from the rich or primary juice diluted by a mixture with the secondary juice prior to clarification, and the resultant settlings again diluted and decanted before pressing. This practice is favoured by some Australian factories, with the exception that the filter-pressing is omitted, the final settling being considered sufficiently exhausted and thickened to run to waste—a very happy circumstance indeed. This practice appears to be a rather uneconomical way of using water, and consequently steam, for heating and evaporation. Filtration to obtain a cake of sucrose content 2·5 per cent.; moisture, 56 per cent.; purity of contained juice 80; and Brix, therefore, 5·3. Assume the settlings 20 per cent. weight of cane containing juice 18·8 per cent. of 15 Brix; water required to dilute juice to 5·3 Brix; = 183 per cent. on juice settlings, or 34·4 per cent. on cane. Assuming 1 lb. bagasse will give 2·5 lbs. steam; 1 lb. steam in quad to evaporate 4 lbs. water, and bagasse per cent. cane 30. The fuel required to remove the dilution water in evaporator alone amounts to 11·5 per cent. of the total supply. This, though a somewhat exaggerated example, would tend to explain to some extent our present high filter loss.

Eventually, a continuous rotary vacuum filter of the Mause patented type was installed, and operated over a portion of last season. Testing its possibilities as a second filter to the plate-and-frame machines, the cakes were broken down to a fairly homogeneous sludge to a solid content of 15 to 19 per cent. The estimated loss of sucrose in filter-cake in this method of double filtration terms of sucrose in cane is estimated at 39 per cent. or a reduction of over 1 per cent. on the usual figure. The capacity of the filter on this work is quoted as 12 lb. press-cake per sq. ft. per hour, or assuming press cake to be 3·5 per cent. on cane, 5·38 sq. ft. filtering area per ton cane. This compares very favourably with the filter-press figure, in double filtration. As a direct filter, the machine gave quite satisfactory results though the thickness of cake is greatly decreased, being $\frac{1}{8}$ to $\frac{1}{4}$ in. thick. Over an observed run, the filter handled settlings at the rate per sq. ft per hour of, minimum, 18·12 lbs. maximum 39·2, average 23·6. This latter figure indicates a filtering area of 17 sq. ft. per ton of cane. Wash-water to the extent of 5 per cent. on weight of cane proved sufficient to reduce the sucrose content of cake to 2·5 per cent. with a purity of filtered juice comparable to that from the presses. Moisture of cake is somewhat higher than that of filter-press cakes, contents of 70 per cent. and over being recorded. The cake, however, is quite firm even at these high moisture contents and affords no greater difficulties in regard to transportation and disposal than does filter-press cake. An endeavour was made to estimate the probable recovery of sugar and labour and cloth charges in comparison with the

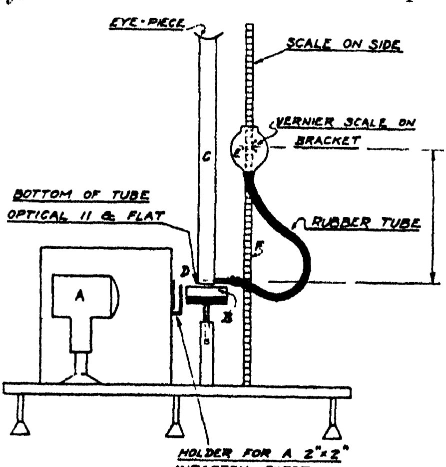
filter-press and is shown in the following tabulation of results, necessarily rather approximate :—

	Filter Press. Present Pract. 1929-30 Season	Filter Press. Double filt. Recorded run	(Estimated) Vacuum Filter. Double filt.	(Estimated) Vacuum Filter. Direct filt.
Sucrose per cent. cake	5·95	1·48	1·63	2·50
Sucrose lost in cake per cent..............	1·47	0·35	0·39	0·75
Recoverable sucrose per cent.	—	—	—	—
Sucrose in cane (S.M.J. Sug. 98 Mol. 45)	—	0·59	0·78	0·59
Relative operating costs (Labour and Cloth)	1·00	1·25	1·18	0·23

[In the discussion following this paper, it was pointed out that the average loss of 2 per cent. in Natal compared with only ½ per cent. in Java ; that many mill owners will spend thousands of pounds on one mill to return 1½ per cent. higher extraction ; and that it would seem as though the day of the filter-press would come to an end before long.]

MEASUREMENT OF THE TURBIDITY OF SUGAR-HOUSE LIQUORS. **C. D. Ingersoll and R. E. Davis.**[1] *Ind. and Eng. Chem.* (Analy. Ed.), 1930, **2**, No. 3, 248-249.

Various attempts have been made to devise some means of measuring the turbidity or dimness of sugar-house liquors, instead of relying on expressions such as "cloudy," "clear" or "brilliantly clear" when the solution is viewed in a tall cylinder. RICE and HORNE's turbidiscope,[2] having as its basis the Tyndall effect, has been found very suitable by operators for the rough control of their liquors when used in conjunction with a series of accurately adjusted standards ; but in this instrument, as well as in the KOPKE, the colour of the liquor interferes with the measurement. An instrument is now described which constitutes a means of numerically expressing with considerable accuracy the relative amount of suspended colloids present in liquors. It is likely to form an important piece of apparatus for sugar factory and refinery control. Its design is based on the following facts : when a beam of light is passed through a turbid solution, the well-known Tyndall effect is obtained;



the brightness of this cone is proportional to the number of particles present in the liquid, that is, to its turbidity ; and the intensity of the cone of light is measured by a spectro-photometer. Its construction is seen from the figure, *A* being the light source, *B* the spectrometer cell containing the liquor under observation, *C* a modified Nessler tube, *D* a monochromatic light filter, *E* a levelling bulb, and *F* a scale rod. A 6-volt, 5-ampere microscope lamp is used as a light source, the beam passing from it through (1) a 1 mm. aperture, (2) a light screen of 6250*A* dominant wave-length transmittal, and (3) a second aperture of 1 mm. diam., to the spectrometer cell (4 × 4 × 1 cm. deep) 25 cm. away. The light screen is a No. 29F Wratten filter. Directly over the spectrometer cell is a modified Nessler tube containing cone-free potassium dichromate solution, saturated at 20°C. By a short side nipple sealed on at the base of the tube and a levelling bulb, the depth of the dichromate solution is adjusted in making the turbidity determination. The depth of the dichromate solution is measured by noting the height of the solution in the levelling bulb above the bottom of the Nesslor tube. The whole apparatus is supported on a black base resting on levelling screws so that it can be levelled at any desired height.

[1] Of the Spreckels Sugar Products Laboratory, Yonkers, N.Y. [2] *I.S.J.*, 1924, 554.

In carrying out a determination, a beam of monochromatic light is passed through the solution under examination at zero depth from the surface of the liquid; the operator then observes the beam of light through a vertical tube having an optically flat bottom ; he then adjusts the depth of the non-turbid dichromate solution until the Tyndall cone is eliminated from his view ; the depth of dichromate solution necessary to effect this blanking-off of the cone is considered a measure of the turbidity of the solution under examination, the results being expressed in cms. of depth at a definite dilution. The object of passing the beam of light horizontally through the solution at a theoretical zero depth is to eliminate colour of the liquor influencing the results. Zero depth is obtained by placing a definite volume of the solution to be examined in the spectrometer cell and raising or lowering the cell until the beam is just below the position of surface refraction of the beam. Sugar-house liquors were diluted with a pure sucrose solution which was almost cone free (if the liquors are not too turbid they need not be diluted), and the following results were obtained :—

Sugar Liquor per 100 c.c. Soln. cc.	Depth of Dichromate Solution Raw Liquor cm.	Vallez press liquor cm.	Shriver press liquor. cm.
1	5·4	6·3	4·4
3	7·8	8·2	6·3
5	10·4	10·2	8·2
10	13·0	12·1	10·1
15	15·6	14·0	12·1
20	18·1	15·6	14·0
25	20·6	17·8	16·1
30	22·8	19·8	18·0
35	25·4	21·9	20·0
40	28·1	24·2	21·9
45	30·4	26·0	23·8

REPORT ON POLARISCOPIC METHODS (DETERMINATION OF SUCROSE BY DOUBLE POLARIZATION). **F. W. Zerban.** *Journal of the Association of Official Agricultural Chemists*, 1930, **13**, No. 2, 188-197.

Four methods were investigated using pure sugar, commercial invert syrup, a mixture of the two, with or without asparagin or aspartic acid : (1) *Invertase method.*— Direct pol. : 52 grms. sample, added basic lead acetate solution, made up 200 c.c., filtered, de-leaded filtrate, 50 c.c. de-leaded filtrate diluted to 100 c.c., this polarized in 200 mm. tube. Invert reading : 50 c.c. of the lead-free filtrate, 25 c.c. water, 10 c.c. of invertase solution, inverted, made up 100 c.c., and polarized. (2) *A.O.A.C. acid method,*[1] as above, but inverted with 10 c.c. dilute HCl during 12 hours at about 26°C., made up 100 c.c., and polarized at 20°C. (3) *Jackson and Gillis method No. II.*[2] Direct pol., 50 c.c. sugar solution previously clarified with basic lead acetate, ammonium chloride solution added, water to 100 c.c., filtered and polarized. Invert reading : 50 c.c. sugar solution, inverted with HCl, cooled, added solution of ammonia to neutralize, made up to 100 c.c., filtered and polarized at 20°C. both direct and invert solutions containing the same amount of ammonium chloride. (4) *Jackson and Gillis method No. I V.*[3] Direct pol.; 50 c.c. sugar solution, previously clarified with basic lead acetate, sodium chloride solution added, water to 100 c.c., filtered, and polarized. Invert reading : 50 c.c. sugar solution previously clarified, basic lead acetate, dilute hydrochloric acid added, inverted, cooled, made up to 100 c.c., filtered, and polarized.

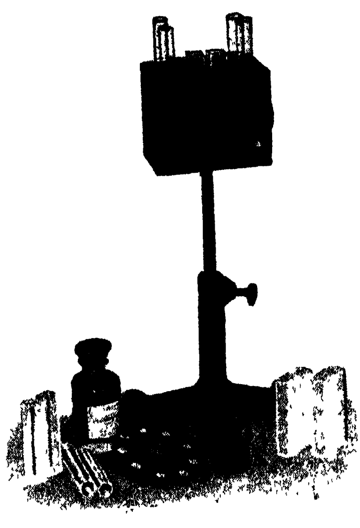
Of these four methods investigated, the invertase method is the only one which can be depended upon to yield the exact percentage of sucrose in the absence of amino-compounds, or very nearly the exact percentage of sucrose in the presence of

1 " Methods of Analysis of the A.O.A.C." 1925 edition, pp. 185-187.
2 *I.S.J.*, 1920, 640. 3 *I.S.J.*, 1920, 641-642.

amino-compounds. Other findings include : The plain acid method may give any kind of a result, depending on the relative proportions between the different constituents of the mixture analysed. It is preferable to carry out the inversion at room temperature, because at high temperatures slight variations in the time used may have an appreciable effect on such reactions as the destruction of invert sugar in the presence of strong acid, on the hydrolysis of reversion products, and of the interaction between invert sugar and amino compounds. The solution used for the direct polarization must have the same dry substance concentration as that used for the invert polarization. The Clerget divisor to be used must be based on the total sugar (or dry substance) concentration, and not on the difference between the direct and the invert polarization.

THE NEW HELLIGE COMPARATOR WITH PERMANENT COLOUR STANDARDS FOR THE DETERMINATION OF THE *pH* VALUE IN SUGAR FACTORY WORK. *Communicated by The Sugar Manufacturers' Supply Company, Ltd., London.*

In determining the hydrogen-ion concentration (*pH* value), chemists have often commented on the inconvenience of handling buffer solutions for the preparation of the coloured standards. This they find especially so in warm climates, where buffer solutions and coloured solution standards may alter after a greater or less time, depending upon the conditions to which they are subjected. It is not always practicable to prepare the buffer solutions afresh as required. In this connexion attention is called to the use of the reliable, permanent colour standards provided by the Hellige Comparator method, which is very simple, and at least as accurate as the colorimetric method as at present performed. In place of the coloured solution standards, prepared from the buffer solutions, one uses a disc containing ten coloured glass plates accurately representing the colour gradations of any indicator. This disc is fitted into a suitable comparator (see illustration). The coloured plates are permanent, and can be relied upon as being entirely exact as to shade and depth of colour. A *pH* determination now becomes an easy and rapid operation, being carried out according to the following steps:



THE HELLIGE COMPARATOR.

One of the rectangular troughs is filled with the liquid (juice or diluted syrup or molasses) under examination and placed in the left-hand space of the comparator ; another trough containing the same liquid plus the indicator is placed in the right-hand space ; the appropriate colour disc is slipped into the comparator ; the colour disc is revolved until equality of colour is reached between the liquid and the standard plate when an observation is made through the sight-hole of the comparator ; lastly the *pH* value is read from a circle in the front of the comparator. It should be explained that on looking into the sight-hole of the comparator, one views a field of vision somewhat as in a polariscope, divided into two parts, which become identical in colour when the final adjustment of the disc is made. Colour discs to cover any indicator can be obtained over practically the full range of the *pH* scale, viz., from thymol blue (1·2-2·8) up to thymol phthalein (9·4-10·6). A reading can be made by interpolation to 0·1 *pH*. If any doubt as to the permanency of the glass standards is raised, the answer is that coloured glass can be made so as to retain its shade unaltered indefinitely. In evidence of this, one may

point to the beautiful colouring of many famous church windows, some of which date back to the 13th century and even earlier, and still retain their delicacy of shade quite unaltered (it would appear) after such great lapses of time. This Hellige Comparator commends itself to the busy sugar factory chemist for the important determination of the *pH* value. It should be capable of rendering him good service in giving reasonably accurate results in the shortest possible time.

PRESS CAKE FERTILIZER. **C. L. Locsin.** *Sugar News*, 1930, **11**, No. 5, 255-260. Press cake (nitrogen, 1·32 ; P_2O_5, 2·24, K_2O, 0·69 and CaO, 7·97 per cent. on dry basis) was applied at the rate of about 75 tons of the wet or say 22 tons of the dry material per hectare, that is about 27 and 8 long tons per acre. This was on the red soils of the Hda. Florencia, Philippines, without other fertilizer. Comparing the results with those obtained on plots on which "Ammon-Phos" (16 : 5 : 24) had been applied at the rate of 250 kg. per hectare (say 2 cwt. per acre), there was a considerable advantage in favour of the f.p.c., viz., 21·6 more piculs of sugar per hectare. Whereas the check plots receiving "Ammon-Phos" had a *pH* of 5·4, those which had been treated with f.p.c. had one between 6·7 and 7·3.—SAMPLING CANE, **G. S. Moberly.** *Proceedings of the Annual Congress of the South African Sugar Technologists' Association*, 1929. In the factory : "Sixteen sticks should be taken at random from different points along the carrier (from at least 75 per cent. of the consignment). These sticks are taken to the laboratory and each one is cut up into four lengths. These lengths are placed in four piles—all the tops in one pile, all the butts in another, and so on. The sixteen lengths are chopped into sections one inch long (done with a suitable machine). These small sections are then well mixed in a basket or bucket and a double handful extracted and passed through the shredder. A Hyatt reducer or a Gallois cutter is recommended for this purpose. One hundred grams of the shredded cane is taken for testing." In the field : "All the canes from a representative stool are taken as a sample, each stool to be taken not less than fifteen yards from any boundary or break. The number of stools to be taken for a sample from a number of fields of the same age should be as follows : 10 acres, 1 stool ; 25, 2 ; 50, 3 ; 100, 4 ; and 200 acres, 5 stools. Each cane should be trashed and topped one node below where the lowest green leaf joins the stem."—CLARIFICATION OF CANE JUICE, USING PEPSIN. **H. D. Lanier.** *Proceedings of the Third Annual Conference of the Association of Sugar Technologists of Cuba*, 1929. Work carried out during the past five years has shown that pepsin and lime in two successive steps permit a separation of suspended and dispersed impurities. A better flocculation is obtained by the lime after the pepsin reaction, and the mud filters faster than with lime alone. Syrup is lower in gum, the dye test showing at least 40 per cent. less colloids than when lime alone is used. Besides, the juice is clearer and lighter, the average Kopke clarity being about 50 per cent. higher.—ADVERSE INFLUENCE OF BURNT CANE IN MANUFACTURE. **José M. Salines.** *Ibid.* Clarification is faulty ; and greater tank capacity required ; evaporators dirty more easily, due to bad circulation ; crystallization is difficult ; the final molasses is increased ; and the sugar is inferior. Figures are given showing that during some weeks 25 per cent. more massecuite-C was obtained in a Cuban factory. A case is known of syrup from burnt cane being impossible to crystallize. It is evident, therefore, that the supply of burnt cane to the factory is a practice to be condemned.—ASEPSIS IN THE MANUFACTURE OF SUGAR. **Juan G. Salinas.** *Ibid.* Preventive measures against loss of sugar by micro-organisms should be practised from the time the cane is cut. Under normal Cuban conditions there is an average loss of 4° of purity, meaning that before the cane enters the factory it has lost 1 per cent. of its sugar. Directions are given for sterilizing the mills, tanks, etc., on the lines recently advocated.[1] Even the centrifugals should be cleaned aseptically, in fact the whole factory should be kept immune from infection so far as practicable, the result being sugar of better keeping quality.

J.P.O.

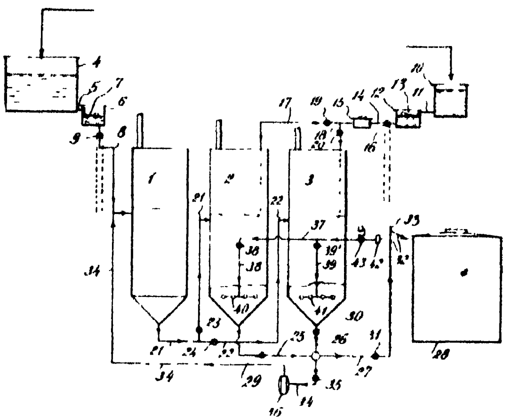
[1] *I.S.J.*, 1927, 367.

Review of Recent Patents.[1]

UNITED STATES.

Carbonatation of Beet Juice. **Arthur W. Bull** (assignor to **The Dorr Company**, of New York). 1,755,165. April 22nd, 1930.

This method of treating beet juice comprises partially saturating it with a liming agent soluble in the juice, carbonatating, mixing in raw juice, and repeatedly circulating this carbonatated juice at least in part through the carbonatated zone. Raw diffusion juice is fed into storage tank 4 ; a sufficient amount is conducted into tank 6 to build up a constant pressure and the chain operated valve 9 is opened to conduct the beet juice through pipe line 8 into the first treatment tank 1. Juice is passed from tank 1 by pipe line 21 into the carbonatation tank 2, until filled to its working level. Valve 24 in the pipe line 22 leading to tank 2 is closed while tank 2 is in operation. Milk-of-lime is fed into the storage tank 10, and finds its way by gravity through pipe 11 into constant level tank 12. The chain operated valve 16 is suitably opened to conduct the milk-of-lime through the "sight-box" 15. Valve 20 in line 18 leading tank 3 is closed so that the milk-of-lime may pass through pipe 17 into tank 2, where it mixes with the beet juice.



When the tanks are filled to their normal operating level, the juice and lime supplied are temporarily shut off, the re-circulation pump 36 is started and gas is admitted for the carbonatation of the mixture already in the tanks. Carbon dioxide gas is fed through the main gas line 37. The pressure of the gas fed to the line is suitably regulated by the pressure valve 42. The valve 39′ in offtake pipe 39 leading to tank 3 is closed so that the gas may be fed into tank 2. Since the gas is made to enter the mixture of beet juice and milk-of-lime near the bottom of tank 2, the bubbles of gas percolate up through the body of liquid. When the carbonatation has proceeded to the usual end point, the supply of juice and lime is again started, valve 31 is opened and the process is then under continuous operation. A portion of the carbonatated juice is conducted from the bottom of tank 2 through lines 25 and 27 into the settling or thickening device 28, while the remainder is pumped into tank 1. About eight volumes of juice are recirculated for each volume of new juice added to the circuit. Completely carbonatated juice is conducted to the settling or filtering device as rapidly as raw diffusion juice is fed into the system. In this manner beet juice may be continuously carbonatated.

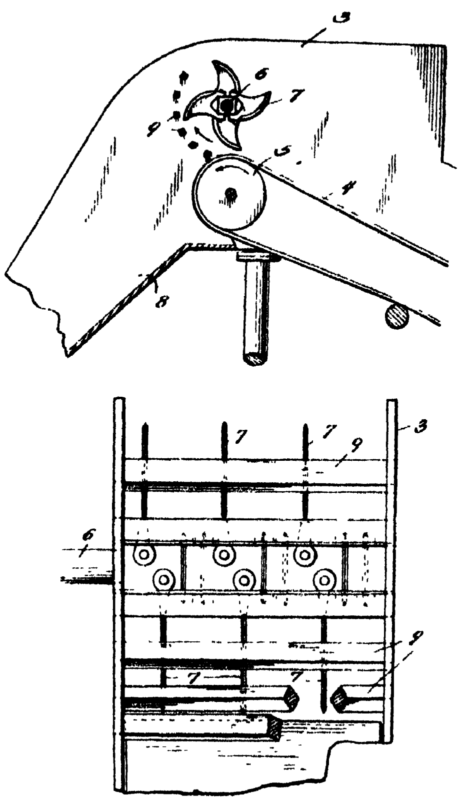
It will be observed that the addition of milk-of-lime to the juice in tank 2 is made while the mixture is being gassed. There is no agitation of juice with lime preceding the carbonatation step. Rising bubbles of gas strike the juice substantially as soon as it is mixed with lime. The interval of time between liming and gassing is negligible under operating conditions. The object is to gas the limed juice before the juice is saturated with respect to lime in true solution. In other words, the juice is gassed when it is but partially saturated with lime, or when its alkalinity is relatively low compared with what it would be when completely saturated with lime in true solution. Since carbonatated juice from tank 2 is made to mix with raw diffusion juice in tank 1, it is apparent that the purifying step above discussed takes place. The carbonatated

[1] Copies of specifications of patents with their drawings can be obtained on application to the following—*United Kingdom*: Patent Office, Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2 (price 1s. each). Abstracts of United Kingdom patents marked in our Review with a star (*) are reproduced from the *Illustrated Official Journal* (*Patents*), with the permission of the Controller of H.M. Stationery Office, London. Sometimes only the drawing or drawings are so reproduced. *United States*: Commissioner of Patents, Washington, D.C. (price 10 cents each). *France*: L'Imprimerie Nationale, 87, rue Vieille, du Temple, Paris. *Germany*: Patentamt, Berlin, Germany.

juice contains calcium carbonate particles in suspension. These particles operate mechanically to purify the raw diffusion juice in tank 1 before it reaches the gassing zone in tank 2. Colloidal matter present in the raw juice contacts with and is adsorbed on these suspended calcium carbonate particles. The lime in true solution removed from tank 2 to tank 1 operates chemically to purify the raw juice. This lime reacts with certain dissolved salts and the like in the raw juice to form compounds that are substantially insoluble in the mixture. Colloidal matter also contacts with and is adsorbed on these insoluble particles. By the time the raw juice from tank 1 reaches the liming and gassing zone in tank 2, it is materially purified. This juice may then be gassed for the precipitation of fresh calcium carbonate particles without colloidal matter being immediately adsorbed on their surfaces. Clean calcium carbonate particles readily lend themselves to particle growth, and, moreover, act as nuclei in the precipitation of calcium as calcium carbonate.

Rotary Cane Cutter and Delivery Mechanism. **Horace Johnson and William A. Ramsay,** of Honolulu, T.H. 1,761,987. June 3rd, 1930.

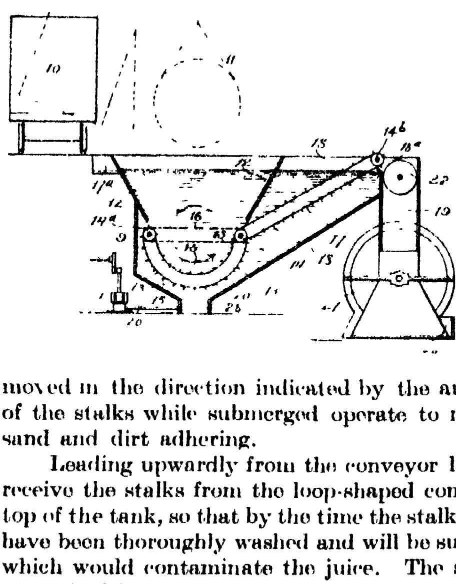
An object of the invention is the provision of means disposed to co-operate with the rotary cutters to cut the cane in transit, which prevents the knives from engaging pieces of cane and throwing the same beyond the knives, and at the same time assists the knives in cutting or slicing such pieces of the cane. A series of bars is disposed at the outlet side of the rotary cutter and disposed in an arc, the centre of which is the axis of the cutter, and in such a position that should any of the cane adhere to the knives of the cutter, the said bars will co-operate therewith and exert additional cutting action upon such cane and thereby insure the proper cutting or slicing of the cane before delivery to the crushers and mill. Referring to the drawings, the numeral 3 designates the main chute through which the cane is delivered by means of the endless conveyor 4 operated upon and guided by the roller 5. Mounted adjacent thereto and above the roller 5 is a transverse shaft 6, which is adapted to be operated at a high speed to actuate the rotary cutters 7 carried thereby, this being of usual construction. The delivery end 8 of the chute is disposed to receive the cut up or sliced cane and deliver the same to the crushers (not shown). The larger pieces of the cane that adhere to or are speared by the knives 7 are sometimes thrown into the chute 8 without being properly cut up. A plurality of spaced bars 9, preferably of angular cross section is therefore disposed adjacent the rotary knives, said bars being mounted between the walls of the chute 3 and disposed substantially upon an arc of a circle, the axial centre of which is the axis of the shaft 6 and just beyond a circle described by the extreme ends of the knives 7. Cane delivered to and acted upon by the knives will also, if too large to pass between the bars 9, be halted in its movement or impeded to such an extent that the succeeding blades will co-act with the bars to additionally cut up and slice



the cane so that, when the cane is delivered through the bars 9 and into the delivery chute 8, it will be much more finely cut up and sliced and therefore in a better condition to be acted upon by the crushers and the cane mill. Although the bars 9 are here shown as rectangular in cross section it is evident that they may be polysided, round, oval or elliptical. Claim 1 is the combination with a rotary cane cutter and a cane delivery mechanism, of means for co-operating with the cutter to prevent the cutter from throwing the cane, before properly cutting up the same, into the delivery mechanism and for assisting in cutting up the cane, the latter means including a plurality of spaced bars arranged upon an arc of a circle, the centre of which is substantially the axis of the cutter.

PREPARATION OF CANE (FOR DISINTEGRATION OR MILLING).[1] **Wm. H. Morgan, Sr.** (assignor, **The Morgan Hurrycane Co.**, of New York). 1,751,838; serial No. 51,092. Patented March 25th, 1930; application filed, August 19th, 1925.

The principal object of the present invention is to provide an improved apparatus for washing or otherwise cleansing sugar cane stalks to remove all juice-contaminating matter therefrom and for separating the leaves and trash from the stalks. In the construction shown 9 represents a tank located below the floor level so that the contents of a cane car 10 can be dumped therein without handling the cane, or into which bundles of cane carried by a sling 11 from an overhead crane, may be readily deposited. The tank is provided with a hopper preferably having inclined ends 12 which direct the cane stalks on to the conveyor 13 preferably loop shaped and located at the bottom of the hopper. The tank is filled with water to a point near the top as indicated, an overflow spout 17ª being provided for the free discharge of leaves and trash. One of the conveyor shafts, preferably 14, is positively driven by a motor, belt or other source of power, and the cane stalks as they are dumped into the hopper fall on to the loop conveyor and are rotated or moved in the direction indicated by the arrows. This immersion and movement of the stalks while submerged operate to remove the waxy substance and also all sand and dirt adhering.



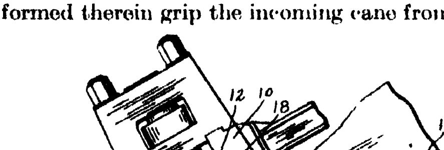
Leading upwardly from the conveyor 13 is an inclined conveyor 17 adapted to receive the stalks from the loop-shaped conveyor and carry them upwardly to the top of the tank, so that by the time the stalks are discharged into the hopper 18ª they have been thoroughly washed and will be substantially free of dirt and other matter which would contaminate the juice. The stalks as they are discharged from conveyor 17 fall on to the circular saws 22 located within hopper 18ª at the upper end of the chute 19. These saws are designed to cut the cleansed stalks into short sections approximately six inches in length, and are preferably driven by a motor 23. The cut sections of the stalks, as they leave the saws 22, fall by gravity down the chute 19, which latter, at its top, is the same length as the saw hopper 18ª. The bottom of chute 19 tapers as shown at 19ª, and guides the cut stalks to a disintegrator 27 of the type shown in Serial 12,410 filed February 28th, 1925. The cut stalks may however be fed by a conveyor to the ordinary pre-crusher and juice extracting rolls now universally used. With the construction it has been demonstrated that by disintegrating the cane, a uniform mat can be obtained which results in an increased capacity of the present mills. It was found that the disintegrated cane absorbs the maceration water more readily than the ordinary crushed cane, owing probably to the fact that the wax covered waterproof shell of the cane

[1] Compare also *I.S.J.*, 1928, 395.

has been broken up thoroughly, exposing the pulpy part. This greatly increases the extraction of the sucrose. It was also found that with the cane disintegrated, smooth rolls can be used in the mills, as these grip the fibres and pull the fibrous mass through the rolls. With this improvement solid polished steel rolls can be used with resulting long life and decrease of cost. Claim 1 reads: "An apparatus for preparing sugar cane stalks for the extraction of the juice therefrom, comprising in combination a tank for containing a cleansing liquid, a loop-shaped conveyor located in the tank and arranged to extend partially about a bundle or mass of stalks deposited therein for imparting a rotary or rumbling movement to said bundle or mass of stalks, a hopper having its side walls arranged to direct the stalks between the side portions of the loop-shaped conveyor, and means arranged to receive the stalks from said conveyor for removing the stalks from the tank after they have been acted upon by said conveyor."

CANE MILL (CRUSHER-SHREDDER TYPE WITH SCRAPER BARS). **Francis Maxwell,** of Wallington, Surrey. 1,752,533; serial 200,890. Patented, April 1st, 1930; application filed June 23rd, 1927.

One of the objects of this invention is to provide a machine of the crusher-shredder type in which the crusher rolls have substantially V-shaped peripheral grooves, and in which is provided a scraper bar having teeth adapted to enter said V-shaped grooves, the scraper bar being operatively associated with the shredding mechanism and adjustable with respect to the shredding mechanism and the crusher rolls. The machine unit illustrated comprises side bearing standards, a pair of toothed rolls 12 and 13 supported thereby, and adapted to feed, press or crush cane passing therebetween, and a shredding roller 14 also supported by the standards. Rolls 12 and 13 are each provided with V-shaped peripheral grooves. Longitudinally disposed grooves 18 intersect each of the grooves to form teeth 19. The grooves of one roll intermesh with ridges formed by the grooves in the other roll. The grooves in one roll are arranged relatively to the other roll whereby the teeth 19 formed therein grip the incoming cane from the chute 15, and feed or draw it therebetween.



Due to the pressure provided between the rolls 12 and 13, the cane is pressed thereby and is crushed or broken into relatively small pieces. A scraper bar 21, having teeth along an edge thereof, adapted to enter into the peripheral grooves in the upper roll 12, and a scraper bar 22 having teeth adapted to enter the peripheral grooves in the lower roll 13, are provided. The scraper bars 21 and 22 extend longitudinally of the rolls over the entire length thereof. The bar 22 is mounted upon a support 23, which is rotatably mounted between the side frames or standards upon trunnions 24, secured thereto in a block 46, secured to each of the frames. Rods 25 and 26, extending respectively toward the front and rear of the machine unit, are adapted by suitable means, such as adjusting nuts 27, to swing the support 23 and with it the scraper bar 22 toward and away from the roll 13 and also toward and away from the shredder roll 14, between which it is disposed. The shredder roll 14 is journalled in a bearing block 28, which is slidably mounted in a guideway 29, formed in the standards. A member 30 extends from the block 28 into an opening 31 in a swingable guideway cap 32, pivoted at 33 to each of the standards. A coiled compression spring 34, the tension of which is adjustable by means of the screw 35, engages the member 30 to urge and retain the bearing block 28 and shredder roll 14 in operative position, and to allow the same to move outwardly under certain conditions during the operation of the machine unit. The shredder

roll 14 is provided with any desired form of shredding teeth, and is disposed relatively to the scraper bar 22, and the roll 13, so that the cane emerging from the rolls 12 and 13 will be acted upon by the shredding teeth 36 in co-operation with that part of the scraper bar 22, which lies between the crusher roll 21 and the shredder roll 14. The arrangement is such that substantially all of the material passed through the rolls 12 and 13 will necessarily be forced by the feeding action thereof to pass through the restricted passageway between the outer surface of the scraper bar 22 and the shredding roll 14. In passing through this restricted passageway, the cane is completely shredded into a mass of loosely intermingled fibres or shreds of cane, that feed down the chute 16 toward subsequent juice expressing mechanisms (not shown). The shredder roll 14 is preferably driven at a relatively high rate of speed by suitable means, such as power-driven belt in engagement with the pulley 37, while the rolls 12 and 13 are driven at a relatively slower rate of speed by means of suitable power means.

PRODUCTION, APPLICATION AND REVIVIFICATION OF ACTIVATED (DECOLORIZING) CARBON. (*A*) **Johan N. A. Sauer** (assignor to **N.V.A. Norit Maatschappij**, of Amsterdam). 1,759,138. May 20th, 1930. (*B*) **Alfred Oberle**, of Oak Park, Ill. (*a*) 1,763,101 ; (*b*) 1,763,102. June 10th, 1930. (*C*) **Friedr. W. Meyer**, of Wismar, Germany. 1,771,719. July 29th, 1930.

(*A*) An apparatus for producing active carbon from carbonaceous material comprising a substantially vertical chamber, baffling means in said chamber so disposed in relation to each other as to produce a plurality of tortuous passages in said chamber running vertically through said chamber, means to heat said chamber, means to introduce finely divided carbonaceous material and gases near the foot of said chamber, and means to draw off activated material at an upper level of said chamber. (*B*) (*a*) A process for producing activated carbon from carbonaceous material, comprising heating the material in the presence of water to a temperature sufficient to vaporize the water and volatile impurities, distilling off the evolved vapours under pressure, and subsequently reducing the pressure, and imposing a vacuum on the material while continuing the heat treatment, thereby effecting a further removal of volatile substances. (*b*) A process of making carbonaceous material including the steps of combining petroleum carbon, an acid sludge, and sawdust, allowing a sufficient period of time to elapse for the acid to attack and disintegrate the cellulose or wood-like material of plant origin, treating with steam to drive off the volatile constituents and recovering the intimate mixture of the acid treated cellulose or wood-like material of plant origin and petroleum carbon. (*C*) Claim is made for a process of reactivating spent decolorizing carbon, which comprises moistening said carbon and subjecting it in a moist condition at a temperature between 180—300° C. to the action of steam within a closed vessel.

JUICE STRAINER. **Thos. M. Nalon**, of Ansonia, Conn. 1,763,978. June 17th, 1930. Claim is made in a cane mill for a juice tank, a trash conveyor provided with side walls, said conveyor being spaced from said tank, a plurality of laterally removable strainer sections between said tank and trash conveyor, means for clamping said strainers against the side walls of said conveyor and means for supporting said strainers while being removed.—RAW SUGAR CONVEYOR. **Wm. H. Hoodless**, of Philadelphia, Pa. 1,764,100. June 17th, 1930. A machine for binning raw sugar from bags has a constantly moving bag conveying apron and means for distributing the bags along the same, a bag emptier consisting of a series of bag carriers adapted to be engaged with the bags while lying on said apron, supports for said carriers, connexions between the bag carriers spacing them from each other and transmitting the motion to one of said bag carriers to the others, said bag carriers being movable in the direction of the movement of the bag conveying apron by the movement of the bag on the conveying apron, and an inclined apron receiving the bags from the discharge end of the bag conveying apron.—CANE PLANTER. **Andrés Quintero Estevez**, of Franklin, Mass. 1,764,159. June 17th, 1930. In a cane planter,

and in combination, a mobile frame, a hopper supported on the frame and provided in its bottom with an opening, a partition in the hopper to provide therein a cane compartment and a fertilizer compartment, means for feeding individual stalks of cane through the opening, means for feeding a quantity of fertilizer simultaneously with each stalk of cane, a plough supported by the frame below the hopper, a pair of vertical walls mounted on the plough to extend rearwardly from the plough in spaced relation to each other, so that the space between the walls is below the opening.—Beet Harvester. **Geo. M.** and **Carl Fuerstein,** of Algoma, Wis. 1,765,224. June 17th, 1930. A beet harvesting machine combines a wheeled supporting frame, a beet topping knife carried by the frame, beet engaging means acting to raise or lower the beet topping knife to bring it in proper relation to the beets, means disposed rearward of said knife and acting to discharge the tops of the beets laterally, and a rotatable top clearer mounted rearward of the topping knife and rotatable in a horizontal plane.—Beet Loader. **Wm. L. Grimes,** of Franklin, Minn. 1,766,293. June 24th, 1930. A beet loader is claimed which combines a wheeled axle shaft, an arch mounted on and rising from the shaft, a pair of forwardly and upwardly inclined side beams disposed in parallelism, the axle shaft being journalled in the side beams adjacent their rear ends, an auxiliary frame depending from the forward end of the side beams, wheels journalled on the auxiliary frame, extensions rising from the rear end of the side beams, a conveyor mechanism, pivot means located rearwardly and upwardly of the axle shaft for mounting the rear end of the conveyor mechanism in the upper ends of the extensions, said conveyor mechanism inclining downwardly and forwardly in respect to the pivot means and having slots through which the axle shaft extends, means on the side beams for raising and lowering the conveyor mechanism, a second conveyor, means for mounting the second conveyor mechanism on the pivot means and on the rear ends of the side beams so as to incline upwardly and rearwardly therefrom, a gear operatively connected with one of the wheels of the wheel axle, a gear in mesh with the first mentioned gear and operatively connected with the rear end of the first conveyor mechanism, and a chain and sprocket mechanism between the second gear and the driving shaft of the second conveyor mechanism.—Beet Harvester. **Fred Driscoll,** of Nisland, S. Dakota. 1,768,195. June 24th, 1930. In a beet harvester, a wheel supported frame, a second frame, means connecting said second frame to said first frame for vertical shifting movement with respect thereto, means yieldingly supporting said second frame, beet top cutting means carried by second frame, a beet top contacting roller arranged in advance of said cutting means, means for supporting said roller from said second frame, ground contacting rollers arranged at the ends of said first roller, means yieldingly connecting said ground contacting rollers to said roller supporting means, and operating means for said cutting means. Beet Harvester. **Wm. B. Conrad,** of Casper, Wyo. 1,768,396. June 24th, 1930. A beet harvester comprises a wheeled frame, a digger carried by said frame at the front end thereof, an elevator receiving the beets from the digger, a divider table arranged at the rear of the elevator and inclining from its centre toward both sides, a shield at the rear of divider table, conveyors arranged at the sides of the divider table and receiving beets therefrom, and rotating cutters arranged between and adjacent the conveyors at the rear of the shield. Saccharate Precipitation Process. **Ralph W. Shafor, A. R. Ness, and Robt. J. Brown,** of Denver, Colo. 1,769,469. July 1st, 1930. The process of precipitating precipitable matter in cold waste water, consisting in diluting the waste water to reduce the concentration of precipitable matter contained therein to one-twentieth or less of its original concentration, and subjecting the mixture to a precipitating heat.—Crystallizer. **Wm. G. Hall,** of Manila, P.I. (assignor to one-half of **Roy C. Pitcairn,** of Honolulu, T.H.). 1, 769,779. July 1st, 1930. A crystallizer comprising a tank to receive the liquor to be operated upon and two intermeshing helical stirrers mounted on horizontal axes in said tank, one stirrer operating in complete submersion and the other in partial submersion in the liquor in the tank.

United States.

(*Willett & Gray.*)

(Total of 2,240 lbs.)	1930. Tons.		1929. Tons.
Total Receipts, Jan. 1st to August 23rd	1,663,027	..	2,548,081
Deliveries ,, ,, ...	1,945,605	..	2,239,558
Meltings by Refiners ,, ,, ...	1,946,158	..	2,104,743
Exports of Refined ,, ,, ...	33,000	..	64,000
Importers' Stocks, August 23rd..	154,693	..	406,754
Total Stocks, August 23rd	313,734	..	606,293
	1929.		1928.
Total Consumption for twelve months	5,810,980	..	5,542,636

Cuba.

STATEMENT OF EXPORTS AND STOCKS OF SUGAR, AT JULY 31ST.

(Tons of 2,240 lbs.)	1928. Tons.		1929. Tons.		1930. Tons.
Exports	2,119,500	..	3,306,268	..	1,570,709
Stocks	1,016,592	..	978,543	..	1,417,997
	3,136,092	..	4,284,811	..	2,988,706
Local Consumption..	51,165	..	53,971	..	45,448
Receipts at Ports to July 31st ..	3,187,257	..	4,338,782	..	3,034,154

Habana, July 31st, 1930. J. GUMA.—L. MEJER.

Sugar Crops of the World.

(*Willett & Gray's Estimates to August 14th,* 1930.)

	1929-30. Tons.		1928-29. Tons.		1927-28. Tons.
CANE.					
America	8,884,164	....	9,190,564	....	8,147,901
Asia	7,341,375	....	7,318,783	....	6,891,715
Australasia	618,163	....	633,066	....	588,163
Africa	717,658	....	737,562	....	656,360
Europe	10,000	....	11,610	....	10,552
Total Cane	17,571,360	....	17,891,585	....	16,294,691
BEET.					
Europe	8,299,762	....	8,420,818	....	8,031,874
U.S.A.	901,713	....	938,640	....	965,241
Canada..............	27,869	....	28,857	....	27,212
Total Beet	9,229,344	....	9,388,315	....	9,024,327
TOTAL CANE AND BEET....	26,800,704		27,279,900		25,319,018

United Kingdom Monthly Sugar Report.

Our last report was dated 8th August, 1930.

The general depression in common with other commodities still continues in sugar. At one moment in the period under review there was a more confident feeling in the thought that some form of world production restriction might be devised, but in the absence of any further news on this head pessimism once more prevailed and prices all over the world relapsed.

The London Terminal Market, apart from one reaction, continued to fall, and new low records have been registered. December moved from 5s. 2¼d. to 5s., to 5s. 2¼d., to 4s. 8¼d., March from 6s. 3d. to 6s. 0¾d. to 6s. 3d. to 5s. 9¾d., May from 6s. 6d. to 6s. 3d. to 6s. 6s. to 6s., August from 6s. 9d. to 6s. 7½d. to 6s. 9¾d. to 6s. 3¾d.

There was little doing in the White Market, but 3000 tons were tendered on the August position, which finished up at 8s. 3d. Since then prices have fallen by 6d. per cwt., the latest quotations being :—

	DECEMBER	MARCH	MAY	AUGUST
Raw	4s. 8¼d. ..	5s. 9¾d. ..	6s. 0¾d. ..	6s. 3¾d.
White	7s. 7½d. ..	8s. 0d. ..	8s. 2¼d. ..	—

Actual sugar has been very slow of sale, although our refiners were kept busy with their Russian contract.

During September the Refiners reduced their prices by 1s. per cwt. 6d. on the 1st September and 6d. on the 8th, their latest prices being No. 1 Cubes 23s. 9d., London Granulated 20s. 1½d.

Business in Raws during August was neglected, but during September some small parcels have been sold from 5s. 8¼d. to 5s. 5¼d.

In Cuba the stock to-day is larger than at any period in its history for this time of the year. The present stock is over 1,000,000 tons larger than last year.

In Europe the beet crop is progressing satisfactorily, and the desired warm weather came just at the right time. Dr. MIKUSCH estimates the European crop, excluding Russia, at 7,584,000 tons against 7,299,000 tons, but Russia he puts at 2,200,000 tons against 921,000 tons last year.

21, Mincing Lane,
London, E.C.3.
10th September, 1930.

ARTHUR B. HODGE,
Sugar Merchants and Brokers.

THE

INTERNATIONAL SUGAR JOURNAL.

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☞ The Editors are not responsible for statements or opinions contained in articles which are signed, or the source of which is named.

The Editors will be glad to consider any MSS. sent to them for insertion in this Journal, and will endeavour to return the same if unsuitable; but they cannot undertake to be responsible for them unless a stamped addressed envelope is enclosed

No. 382. OCTOBER, 1930. VOL. XXXII

Notes and Comments.

The Outlook.

As we write in the first week in October, there is no definite news of any change in the sugar situation : merely rumours and assumptions as to what is happening. A veil of secrecy has descended on the operations of the Chadbourne Committee, and while there have been circumstantial reports that this body is visiting Europe to confer with Java sugar interests, nothing so far has been allowed to leak out as to whether the visit has actually been paid and the negotiations been attempted. What distinguishes the committee from other earlier negotiators, however, is the fact that big banking interests are believed to be at the back of this latest attempt to solve a most difficult economic problem ; and it may well be that silence is desirable till something tangible has been accomplished. It is said that the Chadbourne Committee's negotiations in New York met with a measure of success in respect to the American Overseas possessions, but found the domestic beet and cane industries more difficult to convert to the idea of concerted action. As for Java, we think we are not wrong in opining that once she sees evidence that her principal rivals in other parts of the world are prepared to accept some form of restriction, she will be ready enough to join in the movement. Java can still turn out sugar more cheaply than any other country, but she is finding it increasingly difficult to market her present crop quantity ; China remains too unsettled to prove a good customer, and India seems destined ere long to shut out Java sugar in favour of an increased crop of her own. So it may well pay the Dutch sugar interests to restrict their sugar crop to more manageable dimensions and get a better price for it while they can.

The problem of accomplishing concerted action amongst the big producers in the industry bristles with difficulties, but if any parties can do it, it would seem to be the banking interests. If these fail, then there seems to be nothing for it but to wait till a process of attrition has weeded out the weaker elements in the industry—those whose financial position is unsound, and those whose costs of production are not up-to-date. Unfortunately the attrition will fall most on producers catering for the free market, whereas some manifestly uneconomic producing areas will escape the full consequences owing to the fact that they provide sugar for a protected market.

The position in Cuba at the moment is even more uncertain. At least minor insurrection has broken out, and the President has obtained powers to enforce what is practically martial law during the period of the coming elections. The State bank got into difficulties a few weeks ago, but was assisted by the American houses. Some of the sugar centrals are said to be short of funds, the banks refusing to advance more money. Whether Cuba will follow the example of some of the South American republics and stage a revolution, it is not safe to prophesy, but the whole economic position of the island is comparatively unsound, and discontent is general even if it is not co-ordinated. Since news from Cuba is reported to be censored, it is difficult to guess what is true amongst all the welter of rumours. The next few weeks will probably provide some definite indications of the immediate fate in store for the island.

Beet Sugar Results in the United Kingdom.

On another page we give, as last year, an analysis of the operation figures for the past year of the thirteen British beet sugar companies whose results are available, for which we are indebted to the *Financial Times*. Our contemporary viewing the financial achievements considers that they are far from attaining perfection ; the aggregate net profits for 1929-30 of £541,800 may appear imposing, but this amount is equivalent to only about 13 per cent. of the issues made to the companies during the year from the Exchequer by way of subsidy, so the actual trading is seen to have had results far from satisfactory in a financial sense.

Our contemporary rightly urges an earnest striving after maximum efficiency in every direction as a stern necessity to improve the position. But we are unable to go with it when it recommends a trial of the "newer processes of manufacture for which important claims have been made on the score of greater efficacy and lower cost" and instances the Eynsham desiccation system as appearing promising. It cannot be said that the beet sugar world overseas, which is after all the most experienced section, views this system as having reached the promising stage. It has undoubted possibilities, but the fundamental idea of the scheme is not new and has been experimented with in other beet fields many a year ago. The British beet sugar factories are probably acting in their best interests in sticking to tried and assured methods of manufacture.

Unfortunately they give us no chance of judging whether their present methods are being carried out in the most efficient manner, and this is probably a main factor in creating doubt and scepticism in financial circles. On the Continent it has long been the custom for the factories to publish results of the chemical control applied, especially including the figures for the coal consumption per 100 tons of beets treated. The cost figures for the production of sugar are on record in France for a good number of years past, and a comparison between these figures and those of our factories would certainly be of interest now that the preliminary stage is past.

Queensland loses a Noted Sugar Protagonist.

One learns with regret of the death in July of Mr. G. H. PRITCHARD of Brisbane, for many years Secretary of the Australian Sugar Producers' Association, following on some months of ill-health during which he stuck unfailingly to his work of championing the interests of the Queensland sugar

industry. Born in 1861, and therefore in his seventieth year when he died, he was originally engaged in the banking profession and in this capacity served for over thirty years with the Queensland National Bank, rising to the status of Secretary. He resigned from the Bank at the time of the Kanaka controversy, and as President of the Townsville Chamber of Commerce he was largely instrumental in founding the Australian Sugar Producers' Association. Thereafter till his death he was continually engaged in promoting the welfare of that industry, and in defending the employers' interests in the political sphere and in the matter of industrial awards and regulations. Twice he has visited London, first in 1916 when he represented Australia at a conference called by the newly formed British Empire Producers' Organization that led to the institution of Empire sugar preference; and again in 1929 when he came to urge the granting of an increase in this preference. He proved of considerable assistance to the B.E.P.O. but his hopes last year were dashed by the incidence of a Labour Free Trade Government coming into office, and he had to return to Australia without achieving any immediate results. Unfortunately the trip also proved disappointing from the aspect of his health and a decline set in which ended in his death. Mr. PRITCHARD had a wide circle of friends and his loss will be felt by all who came into close contact with him, whether in business, politics, or in sport of which he was no mean exponent in his younger days. The Queensland sugar industry will be distinctly the poorer for his loss, especially at this juncture when the other States of the Commonwealth are inclined to challenge the fiscal methods of upholding that industry.

Why continue Research Work?

We print elsewhere some details of the results obtained and obtainable from research on the plantation side of the sugar industry. In such widely differing countries as Cuba and India work is being energetically carried on. And it strikes one at first sight to be rather strange, in the present world crisis of over-production and stringency on the plantations, that this should be the case. For it all tends to the production of more sugar still. Fighting cane diseases, introducing disease resistant varieties with greater yields and purer juice, the improvement of the soil and more economical agricultural methods, calling in irrigation on dry lands, and draining low and water-logged areas were never more actively strained after than at present. And it is an interesting exercise to try and suggest reasons for this apparent anomaly. It would almost seem that the world crisis had not penetrated to the scientific mind. And, undoubtedly, there is this to be said for this point of view, that it may be largely a matter of inertia. Large foundations of research are not at present affected financially : the staffs are there and the work goes on—on the lines so deeply implanted on their minds by practical men in the recent years of shortage : the machine has been carefully fashioned and it is now only after years of working that it is functioning properly. And perhaps there is also a tremor of doubt, which causes the scientific worker to try and justify his existence, which is threatened.

But on many plantations this is not the case. Research and even good cultivation are in disfavour because they cost money ; there is a feeling o fatalism which paralyses effort, and a determination not to spend a penny that can be avoided ; and this attitude is perfectly sound. But it is not sound as regards the scientific departments, where there is not the same immediate stringency ; and history does not support any attitude of *laissez-faire* in

research. Cases will occur to every mind, but the outstanding ones are to be sought in the history of Java when nearly ruined by the sereh disease, Hawaii by the leaf hopper and the West Indies by the rind fungus complex—all of them to emerge into comparatively smooth waters with the aid of increased work in research. And there is one good reason which we can offer for a similar increase and continuation of research, in the present unprecedented world crisis in the sugar industry, from the work done on the plantation, through the mill, to marketing the produce. It is essential that the costs of production of sugar should be lessened, and that principally in the raising of the canes on the plantations, which is the most important item of expenditure and, admittedly, the most backward. And this can be best attained by decreasing the area under cultivation and consequently the labour bill. The aim of research everywhere should be to produce the same amount of sugar on a smaller area. The thorough rationalizing of the industry will see to it that the total production of sugar is not greater than the market requires. This is of course not a new idea, and has been for years past insisted upon in countries such as Queensland,[1] where labour is expensive. But it is one that must be acted upon, if the tropical sugar industry is to remain healthy; and no alarm need be felt at the results which are accumulating from the research which has been going on for many years and now bears signs of being brought to fruition. In the coming struggle plantations and factories which have not availed themselves of it and are inefficiently managed will inevitably be wiped out.

The Queensland Sugar Industry.

Since we referred in our August issue to the flare-up that has occurred in industrial and political circles in Australia over the pending renewal of the sugar embargo, further information has come to hand. A *Times* message from Melbourne states that the Federal Government has appointed a Committee representing all interests, including the consumers, to investigate the whole matter and to ascertain whether there is sufficient justification for the Australian consumer to continue paying £36. 10s. per ton for his sugar.

Mr. SCULLIN, the new Premier, has seen representatives of the Queensland interests and heard their case; he has also heard the opposition case, which is brought by the Housewives' Association, by fruit-growers' organizations, and by the confectionery manufacturing interests. Despite the claims of the Queensland Government and the sugar industry, certain critics claimed that the industry was conducted unsatisfactorily, that land values were inflated, that the industry was uneconomic, and even that control was rapidly passing from the British race. What with the contradictory nature of the representations, it is not surprising if Mr. SCULLIN, absorbed in more general problems of Australian economics, should elect to get expert advice from a Committee.

The terms of reference, we are told, will probably include the following subjects: Efficiency in field and factory, land values, costs of production and distribution, feasible economies, effect of sugar prices on manufacturing industries, alien penetration, overproduction of sugar, and the use of sugar by-products. This is a fairly comprehensive list, and we imagine will not be properly investigated in a few weeks.

According to our Brisbane sugar contemporary, the occasion of applying for the renewal of the sugar embargo, which is only another name for a protective duty, was the signal for the opposition to "blaze away in press and in

[1] *I.S.J.*, 1926, 145.

Parliament with a vigour and abandon such as is seldom evoked by even the most serious of national dangers. Facts were ignored or misrepresented, history was brushed aside, and the short-sighted selfishness of ill-informed masses was exploited as though the whole social and financial well-being of the Commonwealth depended upon securing the sale of refined sugar at a price regulated by the cost of raw sugar in countries overseas—countries where, even with all the advantages of coloured labour, the producers are at their wits' end to escape utter insolvency." Apparently England, we may observe parenthetically, is not the only country where "ill-informed masses" are exploited in favour of cheap imports such as threaten to ruin the home producer's business.

Whatever the real cost to the Australian consumer this protection of its sugar industry may be—and the figures loosely given by the opposition are obviously political exaggerations—the pros and cons appear to boil down to this : With the embargo there is an active indigenous industry which helps to people the semi-tropical areas of north-east Australia, and consumes a good deal of the produce and the manufactures of the temperate southern States, as well as bringing two millions sterling into the country from sugar sold over-seas ; without the embargo the sugar industry would cease to exist, in which event some four or five millions would have to be sent out of the country for the purchase of sugar from countries with which Australia has but little reciprocal trade. We fancy that Mr. SCULLIN with his known protectionist predilections will do anything but wreck his country's sugar industry.

Trading Difficulties.

In the *Times Trade Supplement* a discussion during the summer as to the causes occasioning lost orders on the part of British industrialists drew from a British correspondent in Brazil some cogent reasons why in that country our manufacturers labour under very appreciable difficulties in competing with other nations for the goods Brazil needs.

According to him, it is not due to faulty salesmanship, nor to tariffs which are common to all, nor to faulty designs (though it is averred that the British manufacturer is inclined to overdo strength of material and finish, offering a machine that will more than outlast its time as technically useful). It is the high price which all writers on the subject seem to agree is the main cause of Great Britain losing orders, especially to Continental firms. With over 40 years' experience of selling British machinery in Brazil, this correspondent finds it increasingly difficult to compete in some lines in which formerly Great Britain took the best part of the orders. Prices have gone against her ; as an instance the case is quoted of bogie cane wagons of 10 tons capacity, the price of which, c.i.f., was, English £312, and German, £100. 5s. The fault lies in the higher standard of living that has been laid down for the British workman at home since the War ; he has tended to work for fewer hours while claiming more money, whereas his continental rival has been content to work since the war increased hours for less wages. One consequence has been that the British employer, unable to get the orders, has developed a trade stagnation that has been a bar to the obtaining of fresh capital for the introduction of improved machinery and methods. It is argued that the only way to regain lost markets is by lowering wages till goods can be produced at competitive prices and trade revives in consequence. With trade revival and a return of prosperity a higher standard of living for the workman will once more become practicable. But will the British workman, we wonder, ever see it from this point of view ?

Another point raised is that of extended credits. Some of the competitors have apparently strong financial help. One of them on " discovering Brazil " two or three years ago attempted to get a firm footing by offering very extended credits for machinery, up to seven years for final payments. This started a veritable orgy of extended credits which has lasted till now and been followed by other competitors, and many important orders have been placed for machinery on that basis—in many cases without substantial guarantees as to payment. In many such cases our manufacturers are the better for not having taken the orders. Nevertheless, the *Times* correspondent concludes, there is plenty of good business in the machinery line to be had in Brazil on two and three years' terms with well-spread-out easy payments, but it is a financier's business.

The Russian Enigma.

As mentioned in our last issue, Russia is officially credited with a crop for the current campaign of over two million tons of sugar. Doubts are naturally expressed as to whether she can turn out anything like that amount ; but it is increasingly clear that the Soviet authorities are straining every nerve to accomplish the feat as a part of their grandiose Five-year Food Plan, a scheme of agricultural expansion which if it be realized will apparently bring Russia once more to the front as an exporter of food products. These endeavours are, in the absence of independent confirmation, a bit of a mystery to the outside world. In a recent number of the *Journal des Fabricants de Sucre* the gist of an interview with a German engineer lately returned from Moscow throws an interesting light on the ruthless determination of the Soviets to achieve their plans. According to him, the Soviets are making one of the most extraordinary efforts as regards agriculture ever seen in history, in particular in respect to the beet sugar industry. The Sakharotrust (Sugar Union) has developed unprecedented activity and has under its direct control and management 240,000 hectares attached to the sugar factories and 800,000 cultivated by the peasants. Thus for 1930 there seems little doubt that over one million hectares have been sown to beets ; whether the enormous quantities of roots will all be harvested remains to be seen.

The same informant states that the improved Oxford Process of Desiccation is being adopted on a large scale and that drying plants are to be annexed to most existing sugar factories as well as to all new ones being built. Further, it appears that the manufacture of glucose from maize is to be added to some of the beet sugar factories as a trial, with a view to prolonging the campaign. The new factories are stated to have given satisfaction during the last campaign ; in the old establishments much modernization is being undertaken. We are also told that a fine modern laboratory is being built at the sugar technological institute at Kiev. But apparently all this super-organization is being created for the benefit of the nation at the expense of the individual. The latter is only a pawn in the game and every one is stated to be suffering from privations of one sort or another.

That these privations and the general disregard of the rights of the private citizen must result in creating an unwilling body of workers is apparently already the experience of the Soviet authorities, for information to hand in this country suggests that the current year of the Five-year Food Plan has failed to come up to expectations. This year was to have ended on September 30th last, but now it has been found necessary to defer the start of the third year till January 1st next in order to provide breathing space for creating more

favourable facts or figures wherewith to justify the Five-year Plan. This change of dates threatens, however, to make confusion worse confounded for the economists and technical specialists who have to prepare the budgets. The official explanation for the delay is declared to be a discovered " plot " on the " food front " to evoke mass discontent. How far this plot actually existed may never be known, but the indications all point to the probability that however efficient are the organization plans of the Soviet authorities, these ignore the psychological effect on the peasantry, and the latter will remain *sine die* unwilling instruments of Moscow's grandiose schemes. For this reason the divergence between estimate and accomplishment in the beet sugar industry of Russia is liable to loom large for some time to come. Another adverse factor is the increasing absence of trained men with full qualifications for their task. Their number is already insignificant and is decreasing, partly through emigration and partly owing to death, while their replacement is a matter of difficulty owing to a lack of suitable educational facilities.

A Promising Invention.

In these days of pronounced depression in the sugar industry, the lot of the designer who wishes to introduce into sugar factory practice what may be, in the event, an intrinsically meritorious invention is necessarily a hard one. The factory owner has no money to spare on experiments, and the inventor who believes in the merit of his conception must needs try it out, on a factory scale, at his own expense before the industry will accept it as a commercial proposition in which to embark without undue risk. The growing paucity of late years in respect to new patents relating to sugar manufacture is an indication more of the above conditions than, we should say, of barrenness in the matter of fresh ideas. The establishment of new ideas is never easy in the face of vested interests nor, we should add, in that of the ingrained conservatism which is too frequently a feature of a cosmopolitan industry; in days of financial stringency such as the present, success is doubly difficult.

Having regard then to the above premises, we offer no apology in making some reference here to a British invention which after some difficult years of trial in various sugar territories has just passed the test of perhaps the most impartial and judicial body in the sugar industry, the experts of the Java Proefstation. This is the Maxwell Patent Crusher-Shredder, the invention of Dr. FRANCIS MAXWELL whose family have been closely associated with the sugar industry, chiefly in Java, for more than half a century. Its essential features have been described in our pages in various issues of the last few years and need not be repeated here.[1] A demonstration machine was operated in Java as far back as 1924, and then these shredders were introduced into Cuba, Zululand, Egypt, India, and again into Java. In every one of these countries the inventor superintended the initial working of the shredder and at the same time accumulated first-hand knowledge which doubtless enabled any weak points in the design and operation to be eliminated. Since its inception, this apparatus, as is all too frequently the case with inventions which are revolutionary in character, has been subjected to much criticism; doubts were expressed as to the teeth lasting, as to economy of operation, or as to any gain in extraction being assured. The presence of this invention in as many as five sugar factories in Java has however enabled the Proefstation authorities (on their own initiative as we understand) to investigate its claims and record the results achieved in the course of an ordinary crop operation. Their conclusions are given in the latest annual report (of 1929) just issued by the

1 See *I.S.J.*, 1927, 209-213.

Proefstation, a translation of which will be found on another page of this issue. The verdict is undoubtedly favourable to Dr. MAXWELL, and we think he is not wrong in claiming that this sets the hall-mark of efficiency on this invention of his, since the Proefstation authorities are nothing if not critical of new contrivances.

An Analytical Note on the Sugar Crisis and its Solution.

By C. J. ROBERTSON, B.Sc., M.A., Ph.D.[1]

At this stage in the discussion of the sugar crisis and the way out it may not lack utility briefly to pass in review some of the fundamental features of the situation, particularly with the object, in the first place, of clearing the ground, and, secondly, of concentrating attention on certain points that at times seem in danger of not receiving due prominence.

While the special conditions of post-war years have made the present depression, both in the sugar trade and in trade in general, abnormally severe, the fundamental problem remains that of cyclical movement of prices and profits. Normally, as is shown by a study of the diagrams prepared by CAMP, HODGE, and other sugar statisticians to illustrate the course of trade conditions during the past 70 or 80 years, the full cycle of boom and slump in the sugar trade has occupied a period of seven to eleven years, gluts and low prices alternating with deficiency and high prices within this period. Though at the present time, for instance, we happen to be suffering from both a general business depression and a depression on the sugar market, comparative study shows that the sugar trade cycle is distinct from the general trade cycle.

It is true, of course, that there are certain similarities between the two sets of phenomena, such as the over-production that results when the inflow of floating capital in times of rising prices becomes effective. It is also true that the general trade cycle exerts an influence on particular trade cycles such as that in sugar, perhaps, indeed, more notably so in this case than in that of other agricultural commodities, owing to the highly speculative nature of the trade, which renders it especially sensitive to the psychological factor and also brings it into more intimate relation with movements in other markets. The sugar trade is doubtless to some extent affected, too, by the general fall in commodity prices and by the lag of retail prices in a time of falling wholesale prices, phenomena which tend, as PRINSEN GEERLIGS has recently pointed out, to hold back the normal reaction of consumption to low prices. The relationships between the general business cycle and the cycle in a particular commodity, such as sugar, form, indeed, a line of economic research in which a great deal of work has still to be done. The point we wish to emphasize here is that the sugar trade depression is fundamentally distinct from the general depression.

Nor do such recurrent depressions have their origin in climatic factors, for climatic fluctuations bringing about unusually large or small crops generally affect only individual producing regions, though the climatic factor did play a secondary part in bringing about the peak production of 1925-26. It is only rarely that unusual abundance through this cause is found throughout the sugar-producing countries of the world, more rarely, even, that in the case of

[1] Sometime Lecturer on the Economics and Statistics of the Sugar Trade at the City of London College.

other commodities, in view of the peculiar circumstance that the commodity is produced from two such diverse crops as cane and beet. Similar considerations apply to the effect of pests and diseases. The sugar trade cycle being thus primarily due neither to general business changes nor to climatic or other natural phenomena, the causes must lie in business conditions within the industry itself and the problem of their removal be susceptible of approach by improvement in the organization of the industry.

Study of the movement of sugar production over a long period of years shows that it does not consist of a series of ups and downs but has been marked by a succession of sharp upward steps, separated by periods during which production has remained more or less stationary. For the last few years we have been on one of these "plateaus," following on the steep climb of production after the War. Thanks to the normal steady increase in world consumption of sugar, the trend line of production, which must of course, over a period of years, coincide with that of consumption, is steadily upward. The trade cycle in sugar, as in other agricultural commodities, is a cycle not of production but of prices, the periods of low prices coinciding roughly with the "plateaus" of the production line and those of high prices with the steep slopes. The price fluctuations are mainly due to variations in the rate of increase of production, the price falling after a marked upward step in the curve of production.

The curve of consumption fluctuates comparatively little, the elasticity of demand for sugar being small. SCHULTZ has demonstrated that a one per cent. increase or decrease in the New York price decreases or increases world consumption in the same year by only 0·6 per cent. Such fluctuations as there are in consumption are exaggerated statistically, too, since in years when "apparent" consumption is high much of the sugar merely goes to form invisible stocks, while in years of relatively small "apparent" consumption invisible supplies may be being drawn upon, so that the fluctuations in "actual" consumption are even more restricted that those shown by a curve of "apparent" consumption. Only by taking a moving average can the influence of these stocks be eliminated. It is, thus, the course of production and not that of consumption that has the most vital bearing on the problem.

There is no need here to enter into details illustrating the course of the price cycle in recent years. It is important, however, to indicate why the periods of low prices are represented on the production curve by "plateaus" rather than by corresponding depressions, as this sheds light on one of the chief difficulties of the production problem. The relatively small downward elasticity of sugar production is a feature in common with other agricultural products; the sugar producer does not, like the manufacture of non-agricultural products, partly meet a period of low prices by closing down part of his plant. Some of the causes of this downward inelasticity of sugar production apply more especially to cane, others more especially to beet.

In the first place, there is the reluctance to abandon capital investments, which are especially great in the case of cane; the land must be cleared and drained, brought into good tilth, and provided with transport facilities, to say nothing of the expense of erecting an up-to-date factory. (2) There is the difficulty of abandoning cultivation, generally especially marked in the case of cane, owing to the economies of ratoonage and the absence in many cane-growing countries of alternative crops, though the latter difficulty is present in some degree in beet agriculture, too, owing to the practical difficulty of finding another root crop to take the place of sugar-beet in the rotation in many European countries. As for cane, it has been estimated that in Cuba,

for instance, there is only a 15 per cent. falling off in production in a year, supposing no new canes are planted. (3) The self-sufficiency of many growers, especially of beet, enables them to carry on even though the prices of beet are unprofitable, the peasant holding being predominantly run on a subsistence basis rather than with constant regard to the outside markets. (4) The value of the by-products, particularly in the case of beet, may enable the grower to continue sending his product to the factory at a loss during periods of low sugar prices. (5) In some areas, even if attempts are made to restrict the producing areas, unusually favourable climatic conditions may nullify the effect. (6) It takes some time for measures of restriction to have effect, especially in the case of cane, the plan of operations on an estate often having to be worked out two years ahead, and producers are tempted to rely on the normal upward trend of consumption bringing higher prices. (7) The influence of tariffs, subsidies, and other protective measures is very strong, enabling growers, especially of beet, to resist the economic pressure to cut down area under the crop. (8) There is, too, a certain conservative inertia that is especially strong among agricultural producers and helps to prevent migration of personnel and capital to other industries even during prolonged periods of depression.

So much for the downward inelasticity of production that makes rapid adjustment to falling prices difficult. It has been emphasized above that it is the sharp upward movements of production that are chiefly responsible for the recurrent disharmonies between supply and demand in the sugar trade. In the case of this commodity, with its peculiar division into two branches with very diverse conditions of production, resulting, however, in the production of the same commodity, a further step in the analysis, and a most important one from the point of view of international negotiations, is to find whether any one of these branches has the greater responsibility for this tendency of production recurrently to outrun consumption.

The organization of cane sugar production, like that of most other tropical agricultural commodities, is still, though to a decreasing extent, largely of the "plantation" type, that is, of a highly capitalistic nature, in the sense that it is carried on on a comparatively large scale for export by means of large investments from the temperate zone. The total investment in cane sugar production has been estimated at about 1½ billion pounds. It is partly in consequence of this characteristic of organization that cane sugar production shows a much higher degree of upward elasticity than that of beet sugar, its much greater response to the stimulus of rising prices being due primarily to the greater amount of capital at the disposal of the producers. There is no need here to enter into details of the immense upward movement of production in Cuba and Java with the stimulus of high prices after the War. Suffice it to recall that the amount of American capital alone that had flowed into the cane sugar production in Cuba by 1926 was 750 million dollars. Contrast the conditions of beet-growing, carried on predominently, and to a still greater extent since the post-war agrarian revolution in Europe, on medium and small holdings, by peasants with little or no capital resources. The beet crop, too, is grown as part of a rotation in a much more complex agricultural system that does not allow of such highly specialized intensification on one crop in response to temporarily favourable market conditions. Thirdly, the greater upward elasticity of cane production is due to the relative ease with which higher yields per unit area can be obtained, there being much greater scope for improvement by breeding higher-yielding varieties and by improved cultural methods in the case of cane than with beet, which has

already been brought to a comparatively high level of development. The achievement of Java in this direction need not be emphasized here. Finally, not only is there much greater room for increasing cane sugar production by more intensive methods, but there is also no lack of areas in which cane production can be greatly expanded by extensive methods, while good potential beet lands are by no means plentiful. The statistics of the post-war period show with what rapidity cane sugar production can increase, with the stimulus of high prices, possessed as it is of these comparatively great potentialities. The high prices of 1917-21 encouraged much investment of capital in Cuba, Java, Santo Domingo, Brazil, and other tropical sugar producing lands, and these investments came into full effect by 1925-26. In that year cane sugar production was 73 per cent. above the average of the pre-war quinquennium, while beet sugar production had risen only 4 per cent., the rate of expansion in the former being exceeded only by cacao. It is clearly, then, with cane that the greater responsibility rests for the tendency of sugar production to outrun consumption, and it is the comparatively great latent potentialities of future expansion in cane sugar production as against beet sugar that make international agreement among the principal cane sugar producers not merely an important question of the moment but a vital necessity for preventing the recurrence of similar crises in the future.

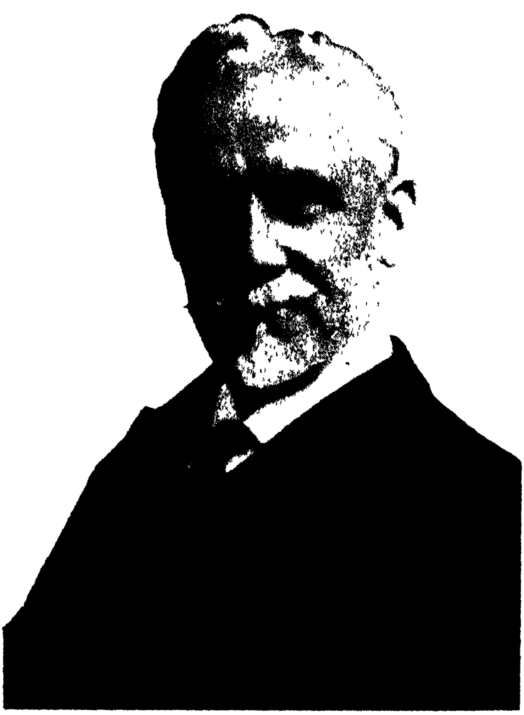
There is a tendency in some quarters to rely somewhat complacently on the general upward movement of world consumption to absorb the surplus, and, especially as the prospects of this process reaching completion in the near future become more hopeful, to allow efforts towards stabilization to relapse. This attitude has two serious drawbacks : in the first place, though in the long run consumption undoubtedly does catch up with the accumulated stocks, in the short run (which is itself proving rather a long run on this occasion) the producers, as there is hardly need to point out, have a very bad time ; secondly, there is the still more important consideration that the same problem will undoubtedly recur more or less regularly in the future, as we see from a study of the past course of events, unless a rational organization within the industry to check the recurrent tendency to over-production is attained. Only by international agreement on this question, particularly, as we have seen, among the cane sugar producers, can something be done to lessen the range of fluctuations in prices and profits. Apart from other disadvantages of persistent extreme fluctuations of this nature, the fact that the periods of low prices are rarely entirely compsenated for by proportionately high prices in the intermediate years makes an attitude of *laissez faire* an unsatisfactory one. If, as recently suggested by Dr. PRINSEN GEERLIGS, the surplus is now a small one, and grounds for optimism as to the position in the near future become stronger, the present seems an opportune time for sounding a warning against a return to such an attitude.

The sugar trade cycle, like the general cycle in world trade, is primarily due not to the inevitable workings of naturé but to the weakness of the economic structure, to the imperfections of human organization. If the will to international co-operation among sugar producers exists, steps can be taken to remove some, at least, of these imperfections. The comparatively great potentialities of upward movement in production in response to rising prices that are possessed by cane make it particularly vital that, if recurrent disharmonies between supply and demand are to be mitigated, such co-operation should exist among the leading cane sugar producers.

Sir Francis Watts.

It seems only the other day that we said good-bye to Sir FRANCIS WATTS, on the eve of his departure for his home in Trinidad, after an absence of over a year during which he visited Mauritius to carry out an Imperial Government inquiry. He was obviously tired out and, being in his seventy-first year, he was feeling that the time had come to retire from his remaining activities. Unfortunately he clung too long to harness, as it turns out, and he reached Trinidad only to take to a sick bed and pass away on September 24th. His end was not altogether unexpected, but nevertheless came as a shock to his numerous friends who had hoped that rest and retirement would enable him to prolong the autumn of his life.

Sir FRANCIS, who was born in 1859, came from the West of England, and his technological training was undertaken at what is now Birmingham University. Practically the whole of his life was devoted to tropical agriculture ; but he started his career as an analytical chemist, securing a Government appointment in Antigua in 1889. Subsequently he held the Government posts of Analytical and Agricultural Chemist for Jamaica, and then for the Leeward Islands. In 1906 Mr. WATTS (as he then was) was appointed to succeed Sir DANIEL MORRIS as Imperial Commissioner of Agriculture for the West Indies, a post in which he was responsible for some valuable reports and papers. He was created a K.C.M.G. in 1917 and in 1921 was made first Principal of the new Imperial College of Tropical Agriculture in Trinidad. Here he remained till he retired in 1924. Since then he has travelled through the sugar districts of South Africa, and has visited Mauritius to report officially on the sugar industry there. This report was published only last Spring and the labour involved in its preparation proved in the event rather too severe a tax on Sir FRANCIS WATTS' strength, and thus must have helped to hasten his demise. But he had a strong sense of duty and gave himself cheerfully and unstintedly to furthering the interests of the industry with which he had been associated all his life. Sir FRANCIS was a man of genial and courteous temperament, and in spite of his long association with Government institutions there was little to suggest the official about him. He made many friends, who will regret that he did not live to see the outcome of his endeavours for the West Indies and Mauritius, but passed away just when the horizon seemed to show signs of clearing and interesting possibilities loomed larger.



SIR FRANCIS WATTS, K.C.M.G.

[Photo by Elliott & Fry.

The International Society of Sugar Cane Technologists.

Some Recent Activities.[1]

Plans for Porto Rico Congress.—According to advices received from MANUEL A. DEL VALLE, Local Secretary, the Sugar Technologists' Association of Porto Rico has held an enthusiastic meeting at Fajardo, attended by about seventy delegates, to make preparations for the Fourth Congress of the International Society. A re-organization was effected and new officers have been elected. Mr. JAIME ANNEXY, manager of Central Eureka, was chosen President, Mr. JERONIMO FONALLEDA, President of Central Juanita, was made Treasurer, and Mr. FELIX R. HILERA, who is the Secretary of the Sugar Producers' Association of Porto Rico, was elected Secretary of the Association. Shortly after this meeting a deputation of the Association waited on the Governor of Porto Rico, THEODORE ROOSEVELT. The Governor manifested a keen and sympathetic interest in the plans for the Congress and promised the active support of the Government of Porto Rico.

The date of the Congress has been tentatively fixed for the last week in February or the first week in March, 1932. At that time the grinding season will be in full swing, the climatic conditions will be most favourable, and the visitors will be able to see more of the sugar industry, in both field and factory, than at any other season of the year. The Conference itself will be followed by excursions to sugar plantations and other points of interest. Some further special features are planned which will add to the interest and value of the trip to Porto Rico, especially for foreign visitors and guests. A more detailed programme will be published later.

Proceedings of Java Congress.—The offices of the General Chairman and General Secretary have received a number of requests from members of the Society for copies of these Proceedings. The Constitution provides that members who have paid their dues for any particular Congress are entitled to a copy of the Proceedings of that Congress. The entire supply of the Proceedings of the Java Congress has been retained in Java, and the General Chairman has requested the Local Secretary for the Java Congress, Dr. V. J. KONINGSBERGER, Proefstation, Pasoeroean, Java, to send copies of the Proceedings to all those who paid their dues for that Congress. Members of the Society who are in this class and have not received their copy of the Proceedings are urged to write individually to Dr. KONINGSBERGER and claim it ; non-members may obtain the Proceedings from Het Algemeen Syndikaat van Suikerfabrikanten, Soerabaja, Java, upon prepayment of Guilders 12.50 (Five dollars U.S. gold).

Regional Sections.—Since the last newsletter was published in May, the Hawaiian Section has been organized by H. P. AGEE, the Dominican Section by R. CIFERRI, and the Indian Section by T. S. VENKATRAMAN. The Vice-chairman for Indo-China, P. VIEILLARD, has asked to be relieved of his duties, because he has been called back to France in connexion with the Colonial Exposition in Paris. Mr. VIEILLARD has been requested to appoint an acting vice-chairman who will carry on the work during his absence.

Work of Committees.—It is gratifying to report that the Chairmen of most of the Standing and Special Committees, in co-operation with the members of their committees, are now actively at work in assembling information in their special fields, to be placed before the Society at the next Congress. This unselfish attitude of men who have heavy demands on their time and energies in the discharge of their regular duties is most deeply appreciated. Their

[1] A newsletter prepared by the Secretary of the Society.

example will undoubtedly be followed by the few who have not yet been able to get their committees organized.

OSWALD SCHREINER (U.S.A.), Chairman of the Committee on Soils, has added the following members to his Committee; W. E. CROSS (Argentine); M. CALMON DU PIN E ALMEIDA (Brazil); J. A. FARIS (Cuba); the Director of the Ministry of Agriculture (Egypt); K. OSHIMA (Japan); H. F. CLARKE (Fiji); W. H. HARRISON (India); J. TH. WHITE (Java); F. A. LOPEZ-DOMINGUEZ (Peru); H. ATHERTON LEE (Philippines); R. FERNANDEZ GARCIA (Porto Rico); AUGUSTO CHOTIN (Dominican Republic); FREDERICK HARDY (British West Indies). The Committee "is attempting to collect references for all soil and fertilizer work done in the principal sugar cane regions of the world, with a view to preparing a bibliography on the subject." RALPH B. DEEMER is in charge of this project, and considerable progress has already been made. A comprehensive programme has also been worked out to secure, as far as practicable, uniformity in the classification of soils.

C. E. PEMBERTON (Hawaii), Chairman of the Committee on Insect Pests, has asked to serve on his committee: J. G. MYERS (British West Indies), U. C. LOFTIN (Cuba), and R. H. VAN ZWALUWENBURG (Hawaii). His committee expects to take up discussions on "the status to date of the principal insect pests of sugar cane in each region represented, with special reference to the parasites of such pests, both native and introduced; artificial distribution of parasites of cane insects from field to field where needed; mechanical methods of insect control; relation of diseases of cane insects to their control on plantations and the artificial utilization of such diseases in plantation practice; quarantine methods against insect pests." Papers on special subjects have also been promised by several members.

G. N. WOLCOTT (U.S.A.), member of the Committee on Insect Pests, is writing a book on the entomology of tropical countries. T. E. HOLLOWAY (U.S.A.), who has kindly supplied this news item states that the chapter on sugar cane insects is particularly interesting and valuable, giving much information which is not available elsewhere.

The attention of the chairmen of committees is called to the necessity of having their reports ready in about a year from now so that manuscripts may reach the Local Secretary in Porto Rico in time to enable him to have reprints prepared for distribution among the delegates at the opening of the Congress.

Collections of Cane Varieties.—This project has been advanced materially but the point has not yet been reached where a public announcement can be made.

Re-establishment of International Commission for Uniform Methods of Sugar Analysis.—F. J. BATES (U.S.A.), has reported decided progress in his negotiations for the purpose of re-convening the International Commission. When the time comes to make specific arrangements, he will notify all those interested in this project.

Symposium on Crystallization.—At the Soerabaja Congress it was suggested by P. HONIG (Java) that the programme of the next Congress include a symposium on crystallization, both from the theoretical and practical standpoint. Dr. HONIG has been appointed a committee of one to arrange for such a discussion to occupy not more than a half-day session, and to invite speakers.

Sugar Abstracts.—A supply of copies of the Open Letter about the abstract periodical sponsored by the Society have been sent to each Vice-Chairman with the request to distribute them and to urge authors in his

territory to send in abstracts of all technical papers published by them since the beginning of this year. Nine of the Vice-Chairmen have so far been heard from and they have promised to co-operate, either personally or through a committee appointed by them. Circular letters with copies of the Open Letter have also been forwarded to all sugar journals and similar publications all over the world, likewise to agricultural departments, experiment stations, technologists' associations, and individuals interested in sugar technology. Some journals have already given publicity to the Open Letter, and others have promised to do so. Several of the institutions addressed have agreed to send in abstracts, and the Research Institute for the Czecho-Slovakian Sugar Industry, in a fine spirit of co-operation, has already submitted abstracts of all articles published by the staff in 1930. It is sincerely hoped that all others will soon fall in line so that this undertaking, based entirely on the goodwill of individuals and expected to prove of the greatest mutual benefit in the international field, may be properly launched. If any journals should wish to reprint any part of "Sugar Abstracts," the Society will be glad to co-operate in every possible way.

Some Remarks and Statistics on the Milling Plant of Sugar Factories in Mauritius.

By F. NORTH COOMBES

At the present date there are 42 factories in operation in Mauritius, which turn out a total of about 240,000 tons of sugar yearly, or an average of 5714 tons per factory. The milling plant generally consists of a cane-cutter (revolving knives) and three mills ; the best equipped factories have a crusher and fourth mill in addition. The machinery is chiefly of British make, but with the exception of about a dozen factories the plant is old and lacks that homogeneity which characterizes modern sugar-houses.

The work performed by the mills taken as a whole is decidedly good, but there is room for improvement in many of the units. The mills' extraction of our best factories ranges between 95·0 and 95·7 per cent., with a dilution per cent. normal juice varying between 20 and 26 per cent., and about 12·5 per cent. fibre in cane. Only 10 factories attain this standard ; the 32 others show extractions between 92 and 94·9 per cent. The average of the 42 Mauritian factories was 94·1 per cent. mills' extraction in 1929, as compared with Java's average of 94·4 per cent. and Hawaii's 97·1 per cent. Our milling plant has to be remodelled if we are to get nearer to Hawaii's results. In Java with their very high yields of cane per acre, they do not contemplate increasing their extraction by erecting stronger mills : it is not necessary. In Mauritius, however, where the crop is by no means heavy, where the richness of canes is far from improving, and where planter's canes are bought too dearly, due to competition and overlapping interests, it is desirable to have powerful mills to ensure the highest extraction possible.

The real progress of the sugar industry in our colony dates from 1900, and from that period up to 1914 very many improvements were made in the *usines*. The World War put a stop to that better equipment, but in the years following progress was resumed and several factories ordered heavier and up-to-date mills. Unfortunately a series of bad years since 1923 have greatly hindered that forward move, and the low price ruling for sugar for some time has put a complete stop to progress in factory equipment. The

three years just elapsed have been a deadlock and manufacturers are at present working at a loss. Unless prices go up through an *entente* between producers in limiting production; or unless our produce is better protected by the British Government, there is not the least hope of improving our factories, and it is even very likely that several of them will have to close down, thus entailing abandonment of cultivation in certain localities. This, of course, would be most detrimental to an over-populated island, with the sugar industry only to support its 410,000 inhabitants.

The writer has just gone into the question of milling improvements, and in his opinion and that of many others in the sugar business, it is high time to discard many obsolete machines and replace them by modern units. Much indeed has to be done; but money is not to be found. If the industry can be established on a sound basis with a fixed price for our sugars, year in and year out, a price that would allow us to work at a profit, then Mauritius will go ahead and will strive to maintain its position in the sugar world (a position we are proud of), so as to bring it to the highest level within the Empire.

Manufacturers of machinery and other equipment in the British Isles would assuredly welcome a change for the better in our staple industry as this would undoubtedly mean the resumption of orders and the transaction of business to our mutual satisfaction. It is also likely that in certain cases, where circumstances are favourable, an impetus may be given to a rational centralization of factories and in this event big mills will have to be ordered and new evaporators, vacuum pans, and boilers would be required to assure of a homogeneous and economical plant.

At the present time, on entering a Mauritian factory, one is often struck by the disparity of the mills. In a train of three mills for instance each may have its special dimensions; there are only 12 factories out of 42 that have all the mills of the same standard. Only eight factories have mills of the same size and from the same manufacturer. In the others one may find a Smith mill followed by a Blaikie and a McNeil, or again a Fletcher, a Cook, and a Fawcett Preston. Further, one will come across a 1st mill of 32 in. × 66 in., a 2nd mill of 32 in. × 72 in., and a 3rd mill of 34 in. × 72 in.; or a 1st mill of 36 in. × 72 in. and two other mills of 30 in. × 66 in.

Cane Knives.—Out of 42 factories, 18 have a cane-cutter (revolving knives); four of these are of British make and the rest are from local firms. The proportion of factories using knives is 42·9 per cent. Of the four imported cane-cutters, two are by Mirrlees Watson, one by Fletcher and one by the United Sugar Engineers.

Crushers.—24 factories have one crusher only, and one factory has two. Proportion of factories with crusher = 59·5 per cent. Of these 26 crushers, 22 were supplied by British engineering firms, principally A. & W. Smith and Mirrlees Watson; 22 crushers are of the Krajewski design, two of the Fulton kind, and two of the crusher-shredder type.

Mills.—There are 139 three-roller mills in our 42 factories, viz.: 42 used as 1st mills, 42 as 2nd mills, 41 as 3rd mills and 14 as 4th mills. One factory has a crusher and two mills only, and 14 factories have a 4th mill. The equipment is expressed as follows:

Class A.—One cane cutter + 4 mills = 3 factories; 1 crusher + 4 mills = 3 factories; 1 cane-cutter + 1 crusher + 4 mills = 3 factories; 1 cane-cutter + 2 crushers + 4 mills = 1 factory; 4 mills only = 4 factories; a total of 14 factories. *Class B.*—1 cane-cutter + 3 mills, = 7 factories; 1 crusher + 3 mills = 13 factories; 1 cane-cutter + 1 crusher + 3 mills = 4 factories;

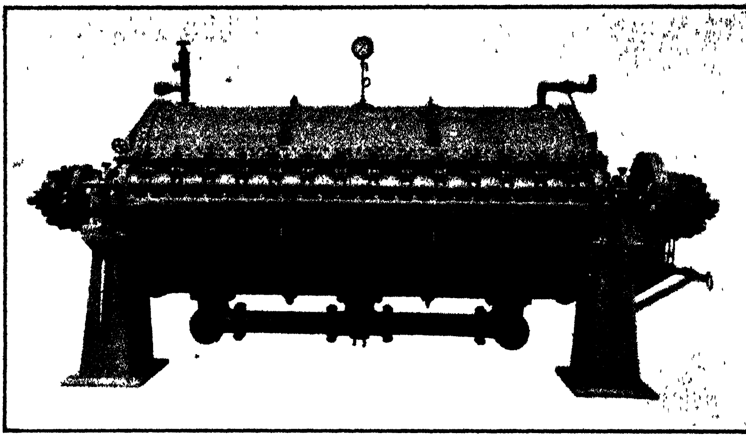


ILLUSTRATION OF 900 SQ. FT. AUTO FILTER.

3 mills only = 3 factories; a total of 27 factories. *Class C.*—1 crusher + 2 mills = 1 factory.

Of the 139 three-roller mills in Mauritius, 31 were made by the local firms Les Forges et Fonderies de Maurice, and Tardieu & Co.; and 108 were imported, 103 being supplied by British makers and five being of French manufacture. The mills made by all firms are classified thus: (1) *British firms*: A. & W. Smith & Co, 37 mills; Mirrlees Watson, 18 mills; Fletcher, 11 mills; Fawcett Preston, 7 mills; Harvey Engin'g. Co., 5 mills; Blaikie, 4 mills; McNeil, 4 mills; Sugar Machinery Mfg. Co., 4 mills; Cook, 3 mills; McOnie, 3 mills; Bever-Dorling, 3 mills; Rushton-Proctor, Duncan Stewart, Robinson, Corby, 1 each, 4 mills; in all, a total of 103 mills. (2) *French manufacturers.*—Cail, 4 mills; Cie de Fives-Lille, 1 mill. (3) *Local make.*—Les Forges and Fonderies de Maurice, 21; Les Forges Coloniales (Tardieu & Co.), 6 mills; The Colonial Engineering Co., 2 mills; unknown (presumed local) 2 mills; a total of 31 mills.

If we look now into the results of these three classes of factories, we have the following mills' extractions (as compiled from the *Controle Mutuel* of the Dept. of Agriculture, Crop 1929: 14 factories, class A (4 mills, etc.) = 94·7 mills' extraction; 27 factories class B (3 mills, etc.) = 93·9; 1 factory, class C (2 mills, etc.) = 92·0. It is interesting to compare our mills' extraction with those of Java for the same year, 1929:—

Mill Equipment.	Mauritius.		Java.
Crusher and 2 mills	92·0 (1 factory)	..	Nil
3 mills only	93·5 (9 factories)	..	92·0 (10 factories)
Crusher and 3 mills	94·2 (15 factories)	..	92·9 (7 factories)
4 mills only	94·9 (5 factories)	..	94·2 (29 factories)
Crusher and 4 mills	94·4 (5 factories)	..	94·8 (39 factories)
5 mills only	nil	..	95·6 (13 factories)
Crusher and 5 mills	nil	..	95·5 (23 factories)

The above statement shows that our mill-work compares favourably with that of Java. Were we to discard our old weak mills, our results would be still better, but, I repeat, we cannot afford, and unless we are helped in one way or another our industry is in jeopardy and our hopes shattered. The highest mills' extraction obtained in 1929 was 95·7 per cent., and the lowest 91·3 per cent.

Dimensions of Mills.—The following is a classification of the dimensions of mills in our factories:—

(*a*) 36 in. × 72 in. = 1 mill; $35\frac{1}{2}$ in. × 87 in. = 3; 34 in. × 78 in. = 4; 34 in. × 72 in. = 1; 34 in. × 66 in. = 1; that is 10 mills from 34 in. to 36 in. diam. (*b*) 33 in. × 72 in. = 1; $32\frac{7}{16}$ in. × $65\frac{5}{8}$ in. = 1; 32 in. × 75 in. = 1; 32 in. × 72 in. = 12; 32 in. × 66 in. = 20; 32 in. × 65 in. = 3; 32 in. × 60 in. = 1; that is 39 mills from 32 in. to 33 in. diam. (*c*) 31 in. × 60 in. = 1 mill; $30\frac{1}{4}$ in. × 61 in. = 1; $30\frac{1}{2}$ in. × 60 in. = 1; $30\frac{1}{4}$ in. × 59 in. = 1; 30 in. × 69 in. = 2; 30 in. × 66 in. = 43; 30 in. × 60 in. = 14; 30 in. × 57 in. = 1; that is 64 mills from 30 in. to 31 in. diam. (*d*) $29\frac{5}{8}$ in. × 66 in. = 1 mill; $29\frac{1}{2}$ in. × 66 in. = 1; $29\frac{1}{2}$ in. × 60 in. = 2; $29\frac{1}{4}$ in. × 60 in. = 1; 29 in. × 72 in. = 1; 29 in. × 66 in. = 4; 29 in. × 65 in. = 1; 29 in. × 60 in. = 2; that is 13 mills from 29 in. to $29\frac{5}{8}$ in. diam. (*e*) 28 in. × 66 in. = 2 mills; 28 in. × 60 in. = 1; $27\frac{1}{2}$ in. × 60 in. = 1; 27 in. × 65 in. = 1; 27 in. × 60 in. = 1; 26 in. × 54 in. = 1; that is 7 mills from 26 in. to 28 in. diam. (*f*) $25\frac{1}{2}$ in. × 54 in. = 1 mill; 25 in. × 60 in. = 1; 25 in. × $44\frac{1}{2}$ in. = 1; $24\frac{1}{2}$ in. × 60 in. = 1; $24\frac{3}{8}$ in. × 54 in. = 1; 24 in. × 60 in. = 1; that is 6 mills from 24 in. to $25\frac{1}{2}$ in. diam., giving a total of 139 mills.

The *biggest* mills are: the 3 mills at "Mon Trésor," "Mon Désert" (ex "Mon Désert Carié") 35½ in. × 87 in. by Les Forges and Fonderies de Maurice, Mirrlees Watson, and Cail, and the 1st mill at "Terracine" factory, 36 in. × 72 in., made by The Colonial Engineering Co., Mauritius. The *smallest*: 24 in. × 60 in. and 24⅜ in. × 54 in. are at "Riche-en-Eau" and "Rivière des Anguilles" factories respectively. Of over 139 mills, only 113 are of 30 in diam and above, i.e., 81·3 per cent. The only factories where the *complete* mill plant has been supplied by one firm, are: (1) "Beau Séjour" where cane-carrier, cane-cutter, Krajewski crushers and 3 mills of 30 in. × 60 in. have been made by Mirrlees Watson; (2) the "Sans-Souci' factory, the largest in the island, where also the cane-carrier, crusher, and four mills of 34 in. × 78 in. have been supplied by Mirrlees Watson; and (3) "Highlands" factory where cane carrier, cane-cutter, crusher and four mills, 32 in. × 72 in., are by the same Scotch firm.

The "Mon Désert" factory at Moka, which scored the best mills extraction last year (95·7 per cent.) has a crusher by Tardieu & Co. (a local firm) and 4 mills 32 in. × 72 in. by Mirrlees Watson. Other examples in this category are: (*a*) "Rose-Belle" factory with one Fulton type of crusher by Mirrlees Watson and 3 mills of 32 in. × 66 in. by Fletcher; and (*b*) "Union" (Ducray) factory, in Savanne, with its 3 mills of 30 in. × 66 in. by A. & W. Smith. An instance of factories with mills of varying dimensions, but by one maker, is "Bel-Ombre," with a colonial cane-cutter and 3 mills by A. & W. Smith.

All the other factories in Mauritius have mills by different makers, and sometimes of various dimensions as well. The chief reason for this lies in the slow and gradual centralization of factories, which has been going on for a good many years; the mills from a dismantled factory were divided amongst others and went either to replace older and weaker mills or were erected as additional units. As matters stand there is still much to be effected in the milling plants of Mauritius, either in scrapping the weaker and older mills or again in creating modern centrals. This will have to come sooner or later.

Only the mill equipment has been considered here; but it is not a moot point that there is more scope for amelioration in the other departments of our sugar-houses, in evaporators, barometric condensers, vacuum pans, boilers, travelling cranes, etc. When our industry is established on a sound basis by a fixed minimum price for our sugars, allowing us to produce at a profit; and when also (as we hope) we have Free Trade within the Empire, then will be the British firms' opportunity of considerably enlarging their business with Mauritius, and also with her friends in need, the West Indies.

The sugar industry can be further developed in our island and we could easily bring our production up to 300,000 tons; this would meet the exigencies of our increasing population and reduce our cost of manufacture by allowing the existing factories or fewer centrals to deal profitably with more canes. May the day be not far distant when our troubles and anxieties for the morrow come to an end, and when we can with fortitude resume our place of vantage among the sugar producers of the British Empire.

LEACH'S ARGENTINE ESTATES.—The annual report of Leach's Argentine Estates Ltd. for the year ending last March shows that a net profit of £32,402 was achieved, as compared with £8462 in the previous season. This sum has been transferred to the reserve which now stands at £88,499. The drop in price obtained for the sugar was fortunately more than counterbalanced by a better yield (9·45 against 8·6 per cent.) and by a reduction in the cost of production. The yield itself was due to very favourable climatic conditions and to a more thorough cultivation. It is stated that the company's crop now in progress is quite up to the average.

The British West Indian Sugar Industry.

Some Data culled from the Sugar Commission's Recent Reports.

(*Continued from p.* 461.)

TRINIDAD.

Trinidad has an area of 1,267,236 acres, of which 314,086 are actually under cultivation, including about 33,000 acres under sugar cane. The population is estimated at about 397,000, out of which some 40,000 labourers are directly employed in the sugar industry or in cane farming. Cacao takes precedence as the principal crop, but the production of sugar is very little behind in respect to value. The cane-growing area is confined to the western coast and is in three belts : the Naparimas to the south, the flat lands of the central belt, and the Caroni plain to the north. The soils of the first and third belts are extremely heavy ; in the central belt, though somewhat lighter, they are equally unsuited to other crops.

The cane is grown in Trinidad either in very large units by the factory owners or in very small ones by a large number of independent cane farmers. In 1928 out of a total production of 824,796 tons of cane, 449,634 tons were grown by the estates and 375,162 tons by some 20,000 small growers. Payment to these farmers for the cane is made on a sliding scale based on the f.o.b. value of the sugar, there being an understood but not guaranteed minimum price of 12s. per ton of cane. The yield per acre is still below 2 tons of sugar.

The method of cultivation of the estates-grown cane is being revolutionized by the advent of mechanically-drawn implements, but it is too early yet to gauge the ultimate effect on the crops. For many years implements drawn by cable-power have been in use on the flat, alluvial soils, but these were not considered suitable for the far more undulating lands of the Naparimas. Tractors have, however, been in use for the last five years and have enabled great progress to be made in ploughing and cultivating. The rainfall in the sugar cane areas of Trinidad averages 65 inches per annum. Most of this falls between June and December, making implemental tillage during these months impossible on such heavy soils. In the dry season the soils become so hard than only the most powerful units are able to pull the ploughs. Cattle-ploughing is almost impossible. Ten-ton tractors are able to pull a four-disc plough only with some difficulty in many of the heavy soils of Trinidad. It can be stated that these soils are now being cultivated for the first time. The operations of preparing the land for planting are costly and, as in the case of British Guiana, it is essential that ratoon crops should be grown. The general practice is to take a plant cane and two ratoon crops.

The usual practice in Trinidad is to make heavy applications of pen manure before planting and in some cases to apply artificial fertilizers to the ratoon crops. The use of artificial manures is the subject of very close experimentation by many of the estates, in which they have the aid of the staff of the Imperial College of Tropical Agriculture ; the Ste. Madeleine sugar estate maintains a staff of experimenters of its own on this and allied investigations.

The standard varieties of cane cultivated in Trinidad are BH 10(12), Uba, and B 156. But a large number of other varieties, including some of the newer POJ canes, are being experimented with. At Ste. Madeleine there is a collection grown in properly laid out plots of the best varieties from a large number of countries, including Barbados, British Guiana, Java,

Porto Rico, Tucuman, Guadeloupe, and Coimbatore. It is this company that first introduced the well-known POJ 2878 into the British West Indies. The Trinidad Department of Agriculture has been raising cane seedlings annually since 1917; none of these has so far found its way into general cultivation, but one or two now being tried show considerable promise. A new departure on one big estate has been the substitution of Uba for seedling canes on a large scale, while Co 213 is finding some types of heavy alluvial soil quite congenial.

Trinidad suffers more as a result of insect pests than most other cane-growing countries. In addition to the small moth-borer, the large moth-borer is capable of doing very considerable damage. Furthermore, the frog-hopper is a serious pest. This insect is known elsewhere but is not considered menacing outside Trinidad. It has been the subject of very careful research for a long series of years. These investigations have had at least one incidental result, in that greater efforts are now being made to improve the cultivation of the soil; it has been proved that the lime content of the soil in many districts is very low and that applications of from 5 to 20 tons of ground limestone per acre will be necessary to neutralize the acidity of the soil. If this deficiency of lime proves to be a cardinal factor in the frog-hopper ravages, as is suspected, it will have to be made good, but the cost of any large applications is too great to be feasible under present conditions.

Of the 12 factories operating in Trinidad, the eight largest manufacture about 90 per cent. of the sugar. Four of those account for 63,000 tons out of the crop of about 90,000 tons, of which some 32,000 tons is turned out by Ste Madeleine alone. These four may be classed as fairly well-equipped and obtain an average overall recovery of about 85·4 per cent., the cost of manufacture averaging about £12 per ton. The average over-all recovery of five of the other eight factories is 73 per cent. and their cost of manufacture about £13. 17s. per ton. Most of these make yellow crystal sugar for direct consumption, so obtain a rather higher sale price than do the factories manufacturing raws. Centralization has been most profitably developed in the south side of the island, where the Usine Ste. Madeleine is situated. In 1929 its sugar was turned out at a cost of £11. 6s. 8d. per ton f.o.b. or considerably below the average figure.

JAMAICA.

Jamaica is the largest of the British West Indian islands, being 144 miles at its extreme length and 49 miles at its extreme width. It is divided into three counties and fourteen parishes, and the agricultural conditions in the various parishes vary considerably according to elevation, rainfall and soil formation. The area is 2,848,160 acres (4,450 square miles), of which 1,157,586 acres are returned as under care and cultivation, but only 270,240 are under tillage; the total area under sugar cane is 43,605 acres. The population is estimated at 974,742, out of which some 30,000 labourers are attached to the sugar industry, forming with their dependents one-tenth of the population.

In Jamaica bananas represent the largest crop, close on 50 per cent. of the total exports being composed of this fruit. Sugar comes next, forming in 1928, with rum, about 19 per cent. of the exports (sugar £710,000 and rum £79,000). The 43,000 acres under cane in 1927 gave a production of 62,525 tons of sugar, against one of 20,000 tons in 1897. Out of the fourteen parishes sugar is grown in ten, but two-thirds of the island crop is now produced in the

four parishes of St. Catherine, Clarendon (including Vere), Westmoreland, and St. Thomas.

Up to ten years ago practically the only cane grown in Jamaica was the White Transparent, one of the very first seedlings produced after the collapse of the Bourbon cane, but as it proved very susceptible to mosaic rapid progress has since been made in introducing immune and resistant varieties, mostly through the Department of Agriculture. The varieties chiefly grown now are BH 10 (12), Uba and White Transparent in about equal areas and a lesser area of Ba 11569, the first mentioned being the most favoured, while Uba is useful in assisting to get rid of mosaic, and Ba 11569 suits the heavier soils. Several of the Java canes are being experimented with, but it will be several years before definite conclusions can be arrived at as to their suitability locally.

The insect pests that cause so much loss to the other islands are of little consequence in Jamaica; the froghopper is not known as a sugar cane pest and even the small mothborer causes but little damage. On the other hand, mosaic has been allowed to get more out of control in Jamaica than in any other sugar-growing island in the West Indies and for many years has occasioned a good deal of loss to the planters.

A considerable amount of pen manuring is done in Jamaica; little or no green manuring is tried, but applications of artificial fertilizer are customarily made; there is, however, considerable need for systematic experimentation in the proper application of manures generally.

The soil in Jamaica is rich and fertile and, with proper cultivation of suitable varieties of cane, yields of from 35 to 60 tons of cane per acre are obtainable. One estate has averaged 36 tons over its whole cultivation. Yet the average yield from the complete returns submitted to the Commission by some 22 factories was no higher than 21·2 tons, a figure that indicates the room for improvement on some of the estates. Field practice varies very widely, from Trelawny where the cane is ratooned perpetually and little or no ploughing is possible to Vere where cable-drawn ploughs are being used. In some districts light tractors are used for ploughing and cultivation. Harvesting methods in some places are still very wasteful of labour, canes being tied up into bundles by hand and untied at the factory; but the system is a consequence of the excessive supply of very cheap labour. On more up-to-date estates, power hoists are in use for transferring the cane.

There are five or six factories in Jamaica that are fully equipped with crushing plants of 11 rollers or more and with complete boiling house equipment, but of these only one is said to record an over-all recovery above 85 per cent.; another records 82 and the remainder so far as they are known range from 72 per cent. downwards. On acount of their large output of high quality rum many of the factories do not attempt to recover a maximum amount of sugar from the juice, being content to pass high purity molasses to the distillery and ferment the sugar, obtaining a high return of rum. But as the market for rum is now decreasing greater attention should be, and in one or two instances is being, paid to obtaining a maximum recovery of sugar, especially where the factory is equipped to do so. In any case the milling work needs improving, as low recovery at the mills is not compensated for by improved return of rum, the sugar not recovered passing immediately to the furnaces in the bagasse.

In some parishes what are efficient factories are unable at present to get sufficient cane to run to full capacity owing to banana growing having extensively invaded the cane contributory areas. In Clarendon parish the crop previously harvested in three factories is all to be dealt with in one factory by

the new owners of the estates, to allow working to maximum capacity and so reduce the cost of manufacture.

In Westmoreland seven small factories turn out together about 10,000 tons of sugar; in these the efficiency is low and, as is the case with field work, an abundant supply of cheap labour is being wastefully employed. Various proposals have been made for the erection of a central factory to serve this area; but on account of the individualism of proprietors and the complications of liens on properties no progress has been made. Since no other crop can apparently take the place of cane in the Westmoreland district, the Commission consider that if the industry is to survive there must be established a modern central factory on a co-operative basis by the estates owners and mortgagees and they deem it a suitable project for Government assistance or that of the Colonial Development Fund. To safeguard the large investment necessary, it would be requisite to obtain contracts providing for the planting of a minimum area in cane by the contributory estates over a period of at least 15 to 20 years.

The growing of cane by small landholders in Jamaica has fallen off greatly in recent years owing to the banana replacing cane in many districts. If the sugar industry is to be retained, it is considered very advisable that the growing of cane by small farmers should be encouraged, as the present tendency of all small-holders to grow bananas only would endanger large communities in the case of a bad hurricane or a rapid increase in the incidence of panama disease, to which the leading banana variety grown in Jamaica is susceptible.

For want of funds the Department of Science and Agriculture has not been able to keep abreast with its experimental work and no well-laid-out experiments are being undertaken to ascertain correct manurial and cultural treatments or to test systematically new cane varieties and establish their suitability for local conditions. The Director of Agriculture estimates that a further expenditure of £4000 per annum is necessary to bring this side of the work of his Department to a satisfactory condition. He advocates the starting of a sugar cane experiment and breeding station in a suitable locality (Hope Gardens not being suitable) and the securing of the services of a well-trained soil chemist.

Correspondence.

COSTS OF PRODUCTION IN JAVA.

TO THE EDITOR OF "THE INTERNATIONAL SUGAR JOURNAL"

SIR,—In the Report of the West Indian Sugar Commission, just to hand, there appears a misleading inaccuracy to which I would call attention.

The table of cost of production in various sugar countries (p. 32) "adapted from one recently published by Lt.-Col. Ivan Davson" (quoted in your July issue, p. 361) shows Java with a production cost of 9s. 3d. per cwt., whereas, in fact, this figure is *less* than 8s. per cwt., thus placing Java on top as the country with the lowest cost of production, and not Cuba.

Pasoeroean, Java, FRANCIS MAXWELL.

13th August, 1930.

NEW COMPANY: UTILITIES IMPROVEMENTS, LTD. (250,657).—Private. To acquire interest in any invention relating to the production, storage, and use of sugar; to carry out chemical or other scientific research or work; to establish workshops and laboratories, etc. Nominal capital, £4500. W. Hann, 7, Shirley Road, Croydon (subscriber).

Recent Work in Cane Agriculture.

SOIL IMPROVEMENT IN RELATION TO CROP PRODUCTION. **G. Clarke.** *Agricultural Journal of India*, XXV, II. March, 1930.[1]

The author commences this interesting paper with a reference to the well worn theme of the world's future supply of food. With an average increase of twenty millions a year, the additional food needed has in the past been obtained rather by taking up new land than by intensification in cultivation ; and the time has now come when, in India and most other countries, there is little fresh land available. He compares India with the United States and France, two other mainly agricultural countries ; and shows by what statistics are available that, while the United States have 2·6 acres in cultivation for the maintenance of each unit of population, and France 2·3, there are only 1·2 acres cultivated in India. The Indian returns of "culturable waste," averaging over 100 millions of acres, are misleading in this connexion ; and it is very difficult in India, as in many other countries, to find new land of the necessary quality for food crops, excepting by the extension of irrigation.

Hence the necessity for India, with her large and increasing population, to take steps to get more food out of her cultivated acres. This, the author remarks, will be a difficult but not insoluble problem ; and he bases this conclusion on his experience in the United Provinces, and largely on the work of the Sugar Research Station at Shahjehanpur. Among favourable factors, are soil that is easy to manage and that quickly responds to treatment, and agricultural workers attached to their calling and with a strong land sense. There is no shortage, moreover, of labour though land must be economized, in striking contrast, say, with Australia and Canada where there is plenty of land but the necessity of developing labour saving devices to the utmost. Weather conditions are difficult and there is a short growing season, needing early maturing and specialized crops : the monsoon is the dominant factor in rural India. Ignorance and a larger share of ill-health than is usual are further adverse conditions, only perhaps to be overcome by extending education of a rural type among the people.

Much has been done in increasing yields by the evolution and distribution of heavily cropping varieties, such as in wheat and sugar cane, "adding crores to the cultivators' income." But this has been a severe test for the plant breeder, and further steps are not to be easily won. The author therefore proceeds to the consideration of the local soil improvement, to the study of which he has devoted himself for the last seventeen years. Commencing with BOUSSINGAULT's great field experiment in 1834, research has been continuous in Europe since that time, and thus India has its tools ready made. In passing, he refers to one conception largely developed at Cambridge and Rothamsted as of great significance, namely, the occurrence of *critical periods* in crops, determined by quantitative observations during the entire period of the growth of the plants. He defines a critical period as "a relatively short interval during which a plant reaches a maximum sensibility to a certain factor which has the greatest effect on the ultimate yield." Observations at Shahjehanpur show two such periods in the sugar cane : (1) in May and early June, when the tillers and root system are developing, and (2) in August and September, when the main storage of sugar takes place. Such periods appear to be associated with phases of growth demanding rapid formation and movement of food material, and a check received at either of them permanently reduces the yield. Acre yield is positively and closely correlated with the amount of nitrate nitrogen during the first period and with soil moisture and humidity in the second.

[1] **Presidential address in the Section of Agriculture, Indian Science Congress, Allahabad, January, 1930.**

Further on, in discussing the maintenance of fertility in cultivated lands, CLARKE pays a warm tribute to the work of the Indian cultivator. Taking the amount of nitrogen in the first foot of soil as an index, he points out that, while certain fertile land has been calculated as containing 20,000 to 25,000 lbs. of nitrogen, the cultivator in the United Provinces has to be content with 1000 to 3000. "In India for at least 1000 years his method of farming has maintained a perfect balance between the nitrogen required and the processes which recuperate fertility." On examination, the North Indian cultivator appears to be the most economical in the world as far as nitrogen is concerned : he is more skilful than the Canadian, and the yield of irrigated wheat is not far removed from the Canadian average. "He does more with his little nitrogen than I have ever heard of." And the present standard of fertility can be maintained indefinitely ; but it must be raised, if the increasing population is to be fed. And this is the main question with which the author concerns himself. In discussing the great development of synthetic nitrogenous manures (equivalent to six million tons of sulphate of ammonia in 1928-1929), he points out that this will be of little benefit to the Indian cultivator unless the land is well supplied with organic matter ; and he therefore concentrates on this known deficiency.

Recently two methods have been placed in the hands of the cultivators, so simple that anyone can use them : (1) the preparation of quick acting manures from waste organic matter and (2) the studied use of green manuring. The description of the former he passes over, as another worker will deal with it later in detail ; but he gives some results of green manuring experiments with sugar cane at Shahjehanpur. By ploughing in, on an average 218 maunds of green manure, which adds 50 maunds of dry organic matter, and 75 lbs. of nitrogen per acre, he was able to raise the yield of cane to 850 maunds (of 82 lbs.) without any fertilizer except the green manure raised on the land itself. The results obtained in 1928 on 27 randomized plots were as follows :—

Green Manure	847 ± 32 mnds. cane	$87 \pm 3{\cdot}6$ mnds. sugar	$246 \pm 8{\cdot}0$ mnds. dry matter.
Control.. ..	649 ± 22 ,, ,,	$67 \pm 2{\cdot}6$,, ,,	$200 \pm 6{\cdot}6$,, ,, ,,

The practical result of this operation was an increase in the value of the crop of Rs. 90 per acre.

The problem in treatment was to find out the conditions in the soil for the decomposition of the green manure, so that (1) the soil is well aerated and with sufficient moisture to prevent rapid drying out after sowing the crop in March, and (2) the nitrogen is in such a form that it is not lost before it is needed, and then is in a form that can be rapidly mineralized for use of the young crop as wanted. If less than 5 in. of rain fall in the first half of September, CLARKE irrigates. By this means an abundant fungal growth fills the soil as it slowly dries, which prevents a large accumulation of nitrates in the autumn, and stores the nitrogen in an easily decomposable organic material (mycelium and microbial tissue) till it is wanted in the mineral form by the young plant in spring. Careful estimates of the nitrogen accumulations were made throughout the year in treated and control plots and are shown in a diagram. The maximum nitrate was found in May to June, just before the rains came and when the canes were half grown, and no further large formation occurred till October, when growth was completed. The yields were in proportion to the mineral nitrogen in the first period, suggesting the importance of available nitrogen in the early stages of growth of the sugar cane ; and thus agreeing

with the results obtained with barley, where 90 per cent. of the total nitrogen has been shown to be absorbed at one third of its growth.

Turning to wheat again, the chief world producers in 1926 (on the whole a good year), in maunds per acre, are given as follows : United States 10·7, France 13·0, Canada 13·2, Germany 17·5, Great Britain 22·5, Belgium 26·3, the United Provinces 12·2 when irrigated and 8·2 unirrigated, but at Shahjehanpur with CLARKE'S treatment 28·8, with an average for 11 years (two of which were partial failures) of 24·4. Soil and climate in North India do not therefore impose serious restrictions on production, and there is no let or hindrance to the yields being raised, at any rate considerably, by the adoption of better agricultural methods. We have only been able to draw attention to a few of the points in this important paper, but sufficient it is hoped to make it worth while for those interested to read it in full.

THE PRESENT STATUS OF SUGAR CANE IRRIGATION IN CUBA. **J. T. Crawley.** *Proceedings of the Third Annual Conference of the Asociacion de Tecnicos Azucareros de Cuba.* December, 1929.

Previous to about twenty years ago, there was but little attention paid to irrigation in Cuba. But the Experiment Station was started in 1904 and soon began investigating the subject. The author commenced collecting information on rainfall, temperature and water supplies in 1907, and published his conclusions in a bulletin in 1909. These he summarizes as the historical basis for later work, as follows.

The amount of water required during its growth by the cane was judged from practice in Hawaii, where they were adding 150-200 in. of water a year to the rainfall, and "crops were increasing by leaps and bounds." But on comparing the monthly rainfalls in Hawaii and Cuba, it was noted that they were heavier in the winter in the former and in the summer in the latter. As the plant would require most water when in full growth, CRAWLEY came to the conclusion that less irrigation would be required in Cuba than in Hawaii.

Temperature.—It was noted that there was a comparative cessation of growth in Cuba each winter, and the question arose as to whether this was caused by the lower temperature or the low rainfall then. The average temperature in the winter was lower in Hawaii, and yet the growth of the canes was satisfactory; from which he deduced that growth would be satisfactory in Cuba if a proper amount of water was available to the plant.

Rainfall.—The average annual rainfall in Havana during a period of 49 years had been 49·3 in. Assuming that the cane will need about 8 in. a month during summer, and that anything less than 5 in. would constitute a drought, he analysed the rainfall returns in this regard, and found that for a period during summer the rainfall was insufficient; and that from October to May it was entirely inadequate: "there is never a year without its continued drought over a period of four consecutive months."

Water supplies.—Little was known about underground water supplies, but enough to indicate that in the red soils at least water was to be found at from 25 to 100 ft. And thousands of acres were being irrigated from such sources, and water was found in most localities on digging shallow wells, this water proving on analysis to be eminently suitable for irrigation of the sugar cane. The problem of utilizing such underground supplies was a simple one, in that there was usually a sufficient slope in the land for surface flow.

The major factors, then, were a capricious and uncertain rainfall, a valuable crop requiring large amounts of water regularly applied, no deficiency in temperature, probably inexhaustible supplies of underground water of a suitable

quality, and a deep rich soil which presented no engineering difficulties. There were however, if the Hawaii practice were to be followed, two problems to be faced : large capital for great installations of powerful pumps to command large areas, and considerable seepage of water from the channels through the permeable red soil from the pumps to the fields. Both of these difficulties have been overcome by the development of electrical energy by a Company with power lines extending throughout the country. Small and inexpensive pumps can be worked near to the fields to be irrigated. It has become the custom to erect pumps raising 500 to 3000 gallons of water a minute, from wells situated on the highest point of a field or group of fields, and then connecting the installation with the nearest power line of the Company.

A fair start has already been made, and there are 73 electric pumping stations of altogether 9433·5 H.P. served by the Company, besides separate installations by Companies and Centrals altogether of 7878·5 H.P., and a number of private concerns the details of which are not available. Assuming that one caballeria (33·3 acres) can be irrigated by a pump worked by 8 B.H.P., lifting 500 gallons 50 ft. per min. and working 10 hours per day, the author estimates that there are already some 1500 to 2000 caballerias irrigated from underground water supplies in Cuba.

CRAWLEY concludes with a reference to the difficulties overcome, and yet to be overcome : " It may be said that the engineering problems connected with irrigation in Cuba are being satisfactorily solved. The agricultural problems are not only more difficult but they are more important." The fields must be properly laid out and prepared, and the water used economically. It is also of the greatest importance that a cane variety should be found which will yield the best returns under irrigation. A cane that responds to intensive treatment will in all probability pay, whereas one that does not so respond or does not ratoon well will only end in failure. The mosaic disease and moth borer are the greatest menaces to success. The former has been successfully studied and there is no longer any excuse for great losses from it, but the borer problem is more difficult. If injury by it proves to be acute under irrigation it will be particularly unfortunate, the losses will be more severely felt because of the increased expenditure on irrigated crops.

Some interesting figures are included in this paper, regarding the extent to which irrigation is carried on in certain parts of Hawaii, together with the yield obtained ; and a shorter reference to the Government reservoirs of storm water on the south coast of Porto Rico for irrigation purposes. These we have had to omit from the present notice.

THREE ESSENTIAL ELEMENTS IN A NEW IRRIGATION PROJECT. **W. P. Alexander.** *Ibidem.*

This paper, also presented at the meeting of the assembled sugar cane technologists of Cuba, may be regarded as expressing the view of Hawaii on the new irrigation projects referred to in the last paper, as far as the local conditions have been appreciated. Nothing could of course be more different than the circumstances of cane growing in these two countries, and the factors concerned in the development of irrigation ; so that, what has been found essential in Hawaii would by no means be fitting for Cuba. The recommendations offered are therefore conveyed in the most general terms, and should be of value in the present stage of development of irrigation in the island.

" To properly appreciate the problems of initiating an irrigation project one must realize the importance of bringing together three professions. The combined efforts of engineers, agriculturists, and field executives are

necessary to successfully plan the irrigation system, to use water in the proper way, and to cultivate the cane so that it reaches maximum yield at the least cost."

For underground water it is a matter for each owner to determine how near to the surface it is, its seasonal variations and whether injurious salts are present. He then will have to turn to the engineer. Location of the wells can only be decided on after a careful study of the whole project; and the choice of pumps depends on their number and kinds, their capacity and the source of power. The original capital cost, interest and depreciation must be held in view; and there should be low operating costs and practically no interruptions for repairs. When satisfied that water is certain and economical, the system of channels must be worked out: built up ditches are expensive and liable to seepage, flumes and aqueducts must be of limited number because of their cost.

The agriculturist must decide whether cane can be grown at a profit, and that the risk involved in irrigation is not too great. The price of sugar must be sufficiently high, and the soil and water suitable. A cane variety free from pests and diseases must be available, with high sucrose attainable during the short growing period in Cuba (as compared with Hawaii ?), and with good ratooning power. He must be prepared to find much money for research as to the food requirements of the plant, and for the purchase of fertilizers. Common sense must be applied to all field operations, i.e., preparation of the land, seed selection, planting and weed control—following the accepted practice in Hawaii, Java, Peru or Porto Rico, till local adaptations have been worked out. The water must be under thorough control, especially near the maturing of the canes. Having attended to all these matters, the agriculturist will be in a position to forecast the yields to be expected, say, 3-4 times the crops in normal years and 5-6 times in years of drought. He must not be too sanguine at the present price of sugar. The greater cost of planting must be spread over several years, and the length of ratooning must be held in view: perhaps three ratoon crops will form the lowest limit for placing his project on a sound basis. From experience in other countries, the margin of profit will be very small unless the price of sugar goes above 2½ cents per lb.

Field organization is likened to the composition of an army. The administrator represents the general, with the engineer and the agriculturist as his staff. Of the officers actually controlling the field workers, the chief of a zone may be compared with the Colonel of a regiment. A chief with energy and determination will succeed where one without those qualities will fail. "A good chief of the zone will command others to so handle the water that there is a happy compromise between the amount of water used and the labour required to apply it. In Java, having little water and cheap labour we have one extreme where cane is watered by men using dippers on longpoles. In Peru we have the other extreme, having much water very little labour is used, and water flows in a semi-flooding system. In Hawaii water and labour are both dear and must be attended to with great care. In Porto Rico water is even more valuable, and its application must receive great attention. Surely Cuba with relatively expensive water and labour must exert great care to secure a uniform application of water and not permit flooding. The field executive or colono, therefore, who will raise the most cane at the cheapest price per ton of sugar, will set up standards of work in irrigation and maintain them."

He will have four guides which will tell him how the water is going. The depth of application in inches (total water used divided by area covered); rate of application in cordeles (tenths of acre) per man (obtained by dividing number of cordeles covered by number of irrigators doing 10 hours of work); amount of water per man in gallons per 10 hour day (dividing the total water used by the number of men employed); and frequency of irrigation (days elapsing between irrigations). A chief of the zone can only qualify for this position, if he watches and understands cost figures, makes certain that all contract work is done as cheaply as possible, and evaluates the work done in terms of increased cane production. Here is a clear exposition of what one of our greatest experts on irrigating sugar cane would do, if he were to undertake the work in Cuba.

THE AGRICULTURAL MANAGEMENT OF SOME IMPORTANT SOIL TYPES IN CUBA. **J. A. Faris.** *Ibidem.*

The author of this paper leads off with the following: "Without fear of contradiction the subject which we have for consideration is the most important problem in sugar cane production in Cuba at the present time"; and points out that among the various materials concerned the soil is the most nearly fixed, that is, the least liable to variation. New varieties of cane are rightly receiving great attention, but it is becoming clearer day by day that their usefulness is tied up with soil types and conditions of growth; and so with cultivation, soil correctives, fertilizers and green manuring. As an example deep ploughing is instanced, going down 15 to 18 in., which is so widely recommended: it has proved very useful in the deep red Matanzas clay, but when tried on other red clays often found associated with it, the results have been disastrous.

The old classification of Cuban soils by colour— reds, mulattoes and blacks—unites soils of the most varying characters. For this reason, the Tropical Plant Research Foundation recently enlisted the services of BENNETT and ALLISON to classify the soils of Cuba along modern lines, and their comprehensive survey of some 100 different types has been recently published. FARIS gives some account of this important work, which we cannot go into here.[1] He emphasizes, however, the dominating importance for the agriculturist of the soil profile, that is, the arrangement and character of the various superposed layers of which it is composed—their colour, structure, consistence, friability, chemical features, presence of intercalated hard pans, sand beds and so on. On these depend such practices as deep ploughing, knifing, depth of planting, burning the trash, renewal of old fields, and a host of other field operations.

He then selects three well known Cuban soils studied by BENNETT and ALLISON, briefly describing their range and character and discussing "some of the fundamentals of soil management as determined by the nature of the top soil and subsoil." It may be noted that these are all clays, and clays appear in almost infinite variety to dominate in the series of Cuban soils.

Matanzas Clay.—This is the typical dark red soil of the Matanzas Province, and covers larger areas than any other single soil in Cuba. The upper 8-12 in. have a slightly brownish cast due to the presence of organic matter, the clay below is slightly lighter red, and does not change materially till the parent limestone rock is reached. The soil is permeable throughout, and because of uniformity of soil and sub-soil, it can be ploughed to any depth desired; soil brought to the surface from a depth of 35 ft. grows good

[1] See *I.S.J.*, July, 1928, for a reference to this book.

cane without any period of acclimatization. Drainage is good and there is no need for ditching; the soil is easy to cultivate, and this can be done soon after heavy rain. Thus, preparation of the land can be done in the summer months, when the rainfall is greatest. The soil is, however, liable to dry rather quickly; and therefore cane should be planted when there is sufficient moisture for germination and early growth, till the young plants have developed strong root systems. It has been found that canes planted from August 15th to October 1st usually give the best results. Owing to the good underdrainage, ease of planting and of harvesting, this soil lends itself well to tillage with the light implements of the small colono. In most areas irrigation can be secured from the underground stores by pumping. The matanzas clay ranks among the best soils in Cuba.

Truffin Clay.—This soil is always associated with Matanzas clay and is often confused with it; it is usually rather flat and often lower than the neighbouring Matanzas clay. It is, however, very different in the character of its layers, having an extremely hard sub-soil, almost stone-like when dry. This heavy, tough sub-soil is impermeable by water and prevents downward percolation; during heavy rains, the 6-8 in. of surface soil are waterlogged, and further rain runs off. During the dry season the top-soil dries out quickly, often as dust or *polvillo*; the cane wilts and the juice deteriorates. In extremely dry seasons the crop shrinks very rapidly, and if cane fires occur the canes are burnt out because of their shallow roots. The chief problem is to increase the water storing capacity, and this can be accomplished by knifing in the dry season, when the hard subsoil is brittle; the effect lasts for some years, and fair crops can be grown. This treatment requires heavy machinery, which is beyond the means of the small colono; and even then ditching is also needed. Obviously concerted action is needed with these treatments where different colonos are cultivating adjacent areas: even if one of them neglects his land, any planting will be hazardous.

Alto Cedro Clay.—Found in all parts of the island, but especially in eastern Cuba: it is probably the second most extensive cane soil in the island. The soil is shallow, often only 2-6 in. deep, and underlain by a series of very plastic clays, impervious and decidedly salt in the lower layers. This soil is always *hogwallow* at the surface, hummocky with *saltagenos* between, varying from slight depressions to 12-15 in. deep. There is every indication that this soil has been formed under salt water conditions, and in some cases the valleys instead of having rich land have too much salt for the cane to grow. When such land is first opened, there is considerable drainage through the decaying roots of the trees, which however do not go very deep; but when the roots decay, the heavy plastic clay runs together and yields rapidly decrease; and the same occurs when knifing is practised. Deep ploughing is obviously inadvisable; although bringing up an inch or so of the subsoil at a time has been found useful to deepen the soil. Because of the impregnation with salt, evaporation must be reduced to a minimum and cane fires must be avoided as tending to concentrate the salt near the surface. Subsoil water supplies are obviously unsuitable for irrigation. Large drainage schemes will be necessary even on small crop areas, and this soil is not adapted to small farm development without government or co-operative assistance.

This drainage problem of the impervious clays which are often among the richest soils in Cuba is the theme of a long paper by Menendez Ramos, also read at the Conference; but space precludes a consideration of this paper at present.

C. A. B.

The Maxwell Crusher-Shredder.

Results of Investigation by the Proefstation of Java.

The latest annual report (1929) just issued by the Proefstation of Java contains the results of an investigation officially carried out by this Institution, on its own initiative, to determine the merits of the Maxwell Crusher-Shredder. This report concerns the installation at s.f. Poppoh (there are four others working in Java), which factory has maintained its outstanding milling achievement ever since it converted the existing Krajewski Crusher into a Maxwell Crusher-Shredder three seasons ago and adopted attendant alterations to the grooving of the mills as suggested by Dr. MAXWELL.

The report slightly condensed reads :—

THE REPORT.

Table I gives the results of the investigation.

These figures were calculated on the basis of the common assumption :—

Purity juice of last bagasse = Purity juice last mill.

As shown in Table I, comparatively high figures for "colloidal water per cent. fibre" were obtained during the tests. There is, however, no reason for doubting their correctness, since by stopping the milling train at the beginning and the end of the test the principal observations could be carried out with sufficient accuracy. Moreover, the conclusions are little or not at all influenced by possible deviations of this figure.

Milling work.—In season 1927, 1928 and 1929 and during the tests the data were respectively :—

Season	Tons Cane per day excl. stops	Imbibition per cent. Fibre	Lost Juice per cent. Fibre	Residual ratio 1st Mill	Residual Ratio 2nd + 3rd + 4th Mills	Residual ratio Total
1927	1059·1	120	54	98	—	90
1928	1162·8	147	45	—	—	84
1929	1190·1	139	25	—	—	76
Tests	1296·4	132	24	69	90	73

It is to be noted that in 1927 the installation at s.f. Poppoh consisted of a crusher and three mills,[1] all provided with feeding rolls. In 1928 the crusher was converted into a Maxwell Crusher-Shredder ; the three rollers of the first mill were provided with special V-shaped grooves and the front and back rollers of the second and third mills provided with Messchaert grooves.

In the first period of the season 1928 the Crusher-Shredder was still going through an experimental stage, during which time very bad results were obtained. The influence of the unfavourable working of the milling train during this time is noticeable in the average data for the whole season. In the last period of that season, when experience produced good work by the Crusher-Shredder, the following data, for instance, were obtained :—

Tons Cane per day excl. stops	Imbibition per cent. Fibre	Lost Juice per cent. Fibre	Residual Ratio.
1211·8	137	39	73
1245·6	117	38	74

It will therefore be more correct to use these figures for the purpose of comparisons.

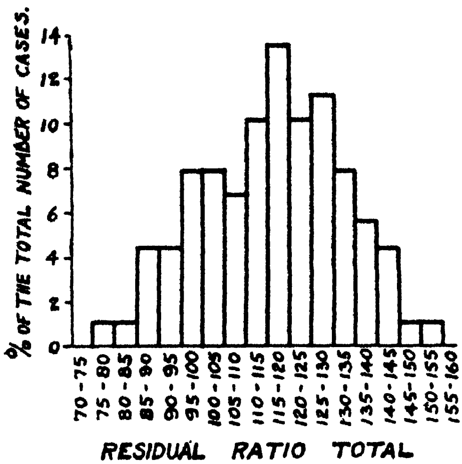
In season 1929 a fourth mill was added to the existing installation, provided likewise with a feeding roll and Messchaert grooves on the front and back rolls.

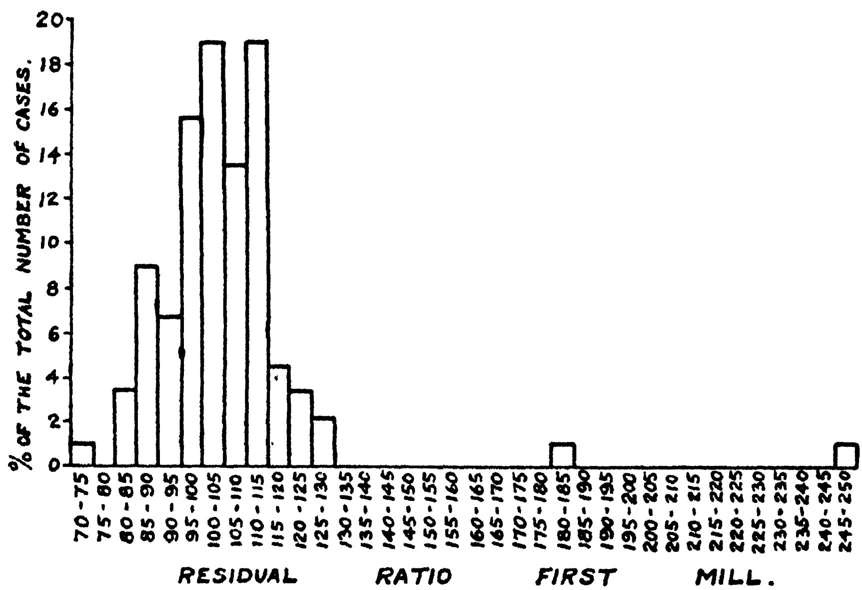
[1] Crusher 30 in. × 60 in., Mills 32 in. × 72 in.

Table I.

Date	Tons cane daily exclusive stops	Primary Juice (crusher) Brix	Primary Juice (crusher) Purity	Juice last mill Purity	Juice last mill Pol.	Per cent. bagasse last mill Pol.	Per cent. bagasse last mill Moisture	Per cent. fibre. Imbibition water	Per cent. fibre. Moisture last bagasse	Per cent. fibre. Undiluted juice	Per cent. fibre. Juice in cane	Per cent. fibre. Colloidal water in cane	Per cent. fibre. Residual juice bagasse 1st mill	Per cent. Cane Pol.	Per cent. Cane Fibre	Undiluted raw juice per cent. cane	Extraction	Residual Ratio 1st mill	Residual Ratio 2nd + 3rd + 4th mills	Residual Ratio total	Fibre per cent. bagasse 1st mill	Fibre per cent. bagasse last mill
5 August	1188·3	19·57	87·38	75·66	2·30	1·85	43·3	182	80	23	654	39	102	13·8	12·6	79·4	96·9	65	87	70	41·64	54·33
9 „	1310·5	19·00	89·68	79·37	2·50	1·98	41·4	157	74	23	640	40	102	13·8	12·8	78·9	96·7	69	86	70	40·35	56·10
10 „	1373·6	18·72	86·72	78·06	2·42	2·07	41·3	144	74	25	641	35	101	13·1	12·9	79·2	96·4	68	94	76	41·13	56·00
11 „	1336·0	18·99	87·41	76·47	2·86	2·02	41·9	136	76	25	675	35	101	13·3	12·3	80·0	96·6	70	93	75	40·05	55·41
12 „	1273·5	19·70	87·46	77·50	2·79	2·08	41·9	140	76	25	644	40	101	14·0	12·7	78·8	96·6	72	90	76	39·38	55·46
Average	1296·4	19·20	87·66	77·41	2·57	2·00	42·0	152	76	24	651	38	101	13·6	12·7	79·2	96·6	69	90	73	40·49	55·49

The method of imbibition was in 1927 : water after second mill, and third mill juice after first mill ; in 1928 : water after second mill, third mill juice after first mill and second mill juice after crusher-shredder ; in 1929 : water after third mill, water after second mill, third and fourth mill juice after first mill, second mill juice after crusher-shredder.





Graph.

Although the values obtained during the tests and those appearing in the " Final reports of Milling Control " are not quite comparable, as they were derived from a different number of observations, there appear to be such differences in respect to the " residual ratio of first mill " and the " residual ratio total " that it may be concluded therefrom that in season 1928, and especially in season 1929, a very great improvement has been achieved by the first mill and by the total milling plant.

This better working is to be attributed to :—

(1) the better preparation of the cane.
(2) the special V-shaped grooving of the first mill.
(3) the imbibition of the second mill juice before the first mill.
(4) the application of Messchaert grooves on front and back rollers of the following mills.
(5) the increase of the quantity of imbibition water.

If the milling result of the last period in season 1928 be taken as basis of comparison, then taking the above circumstances into account, the gain in undiluted juice per cent. fibre in season 1928 for Poppoh was about 16,[1] and the further gain of undiluted juice per cent. fibre in season 1929 by adding a fourth mill was about 13.

More generally, a comparison may be made between the working of the crusher-shredder and first mill of s.f. Poppoh and the working of crusher and first mill of milling trains consisting of crusher and four mills.

In order to enable such a comparison to be made, we have taken from the " Final Reports of Milling Control " for this group of installations, the figures representing " Residual Ratio of first mill " and " Residual Ratio total."[1] These different residual ratios are shown in the accompanying graph. In this graph are set out horizontally the " Residual Ratios" divided in groups increasing by 5, and vertically the number of cases in every group as percentage of the total number of cases. Comparing the values of "Residual Ratio of first mill " and " Residual Ratio total " for s.f. Poppoh with this graph, it will be seen that the Poppoh figures are lower than the best working crusher and first mill and lower than the best working milling trains of crusher and four mills.

Price of Maxwell Shredder.—The price of the shredder roller, roller-bearings and drive amounted to £1500 (18,000 guilders).

This price was increased by the costs for replacing the existing cast-iron crusher headstocks by cast steel ones, the renewal of the supporting columns of the crusher headstocks and the costs of grooving and royalties for the Messchaert grooves.

The total costs accordingly amounted to about £3000 to £4000.

The maintenance costs in regard to knives amount to £200 per year, to which is to be added £13 in costs of lubricating oil and grease for the roller-bearings and driving machine.

It is now expected that one set of shredder knives, costing £225, can be used for two seasons.[2] About 30 per cent. of these knives are to be written off each year owing to damage.

Taking the depreciation over 10 years and interest on capital at 6 per cent., the amortisation costs for the first year would amount to £535 to £665 and the total costs £747 to £879, which thus includes the maintenance costs of £213.

If these costs of depreciation and maintenance of the new installation be calculated as costs for the manufacture of the extra sugar gained (equivalent to 16 parts of undiluted juice per cent. fibre) then we find that for the first year the cost of manufacturing this extra sugar gained amounts to £2. 10s. 0d. to £3. per ton. There is a great difference between this price and the normal cost price of manufacturing sugar, and, therefore, at a reasonable selling price of sugar a considerable profit is to be made of the extra sugar extracted. The

1 See explanatory footnote at the end of the report.
2 With the present 4 in. knives this has since been definitely proved

conversion of the crusher into a Maxwell Crusher-Shredder is accordingly profitable in every respect.

Power required by the Shredder.—Since the driving engine was not provided with an indicator, the H.P. could not be indicated, but means were adopted to determine the brake horse power required. This was found to be 13 B.H.P.

Though no mistake could be detected, this figure seems to be too low, especially since the shredder at s.f. Peterongan, where this roll is placed on the first mill, shows a power consumption of 40 H.P. on the motor.

At any rate these figures show that the power required to drive the shredder roll is low and thus also the steam consumption.[1]

Summary.—The results of our investigation regarding the Maxwell Crusher-Shredder may be summarized as follows :—

The entire installation makes a very favourable impression, in respect to the reliability of working, the power and steam consumption, the maintenance and attendance as well as to the smooth and regular working of the whole milling plant.

The profit derived from the conversion of the crusher into a Crusher-Shredder and the special grooving of the different mill rollers is estimated by us at about 16 parts of undiluted juice per cent. fibre.[2]

The maintenance costs, which are principally confined to the replacement of knives, represent a very small amount which may be taken to be about £213 yearly.

The cost of the extra sugar gained under the conditions at s.f. Poppoh amounts to £2. 10s. 0d to £3 per ton of sugar.

The difference compared with the normal cost price of sugar is so remarkable that at the least reasonable selling price of sugar a high return for the capital invested is realized.

JAVA 1930 CROP ESTIMATES.—At the beginning of October the current Java sugar crop was officially estimated at 2,948,500 metric tons (2,902,000 long tons) of real sugar, or 2,860,000 long tons on the head sugar basis—an increase of 0·2 per cent. Planted area for 1931 is estimated at 199,594 hectares, as against 198,690 hectares, an increase of 0·5 per cent.

VIEWS IN JAVA ABOUT THE SUGAR CRISIS.—The serious situation in the sugar industry was discussed in the People's Council in Java at the beginning of August, when a member expressed the view that the prospects of the industry were gloomy in view of the fact that there were still a million tons of sugar in the go-downs of Java; the speaker even declared that producers in the long run would be obliged to throw up the sponge. Their markets in both China and India were affected by the unsettled conditions, China being incapable of buying anything as a result of the slump in silver. And they viewed with apprehension the large stocks of sugar in Cuba.

1 Since this report has been issued the following data to hand prove that the figure obtained by the Proefstation was, after all, not so far off the mark.

Power consumption of Maxwell Shredders at :—

s.f. Tjomal	..	capacity 2200 tons daily	.. 50 B.H.P.
s.f. Djatiroto	..	,, 1600 ,, ,,	.. 30 B.H.P.
s.f. Tjeweng	..	,, 800 ,, ,,	.. 12 B.H.P.

2 Since this term is not yet widely familiar in other cane sugar countries, the significance of the gain derived from the above installation may be better appreciated from the following interpretation :—

A gain of 16 points in "undiluted juice per cent. fibre" in this case is equivalent to an additional recovery of about 300 tons of sugar at the end of the season. Since s.f. "Poppoh" produces roughly 13,000 tons of sugar in a season, the gain amounts to 2·3 per cent. of the total seasonal output.

The cost of manufacturing the extra sugar gained according to the Proefstation, being £2. 10s. 0d. to £3. per ton of sugar, the reader may readily calculate for himself what the total profit amounts to per season.—ED.

The Toxic Action of Magnesia on Sugar Cane.

By MAURICE BIRD, B.Sc.

For many years now the sugar industry of British Guiana, located principally on the alluvial coast lands, has been troubled at times acutely, by what was more or less vaguely believed to be a form of root disease, emanating from an insanitary soil condition. In 1925 it assumed, in one part of the Colony at least, so threatening an attitude, that unusual efforts were made to explain the cause. The only definite symptoms appeared to be the withering, and ultimate death, of stalks and stools of cane, sometimes in small quantities, sometimes in large.

No specific disease could be diagnosed, but on analysis of the cane the writer found an unusual quantity of magnesia, especially in proportion to the lime present. Four years later the writer was called to an estate where the "disease" was even more acute, and here again the magnesia of cane and soil was still higher, both in percentage and in proportion to the lime. Indeed, analysis of two samples of the ash of the dead cane gave 24·28 and 25·40 per cent. magnesia respectively, both soil and cane showing over three times as much magnesia as lime.

In order to observe the effect of magnesia, when applied directly to sugar cane, four stools were selected in a section, looking and growing well, and near the roots of each eight ounces of Epsom Salt (containing about sixteen per cent. magnesia) were buried on the fourth of May, this year. When the cane was re-visited, on the fifteenth of the following August, these four stools were found to be dead, while the rest of the field, and section, was apparently growing vigorously. Two samples of the dead cane yielded the following figures for lime and magnesia :—

		Per cent. Cane.	Per cent. Ash.
1st Sample	Lime	0·0015	0·131
	Magnesia	0·0024	0·204
2nd Sample	Lime	0·024	0·539
	Magnesia	0·084	1·904

The time of the experiment was one of excessive rainfall, the total precipitation being 41·49 in., which, by keeping the magnesia solution dilute, should have given the cane an unusual chance to cope with the poison ; its death therefore, under these circumstances, seems to emphasize the danger to cane of excessive magnesia in the soil, which appears to be prevalent throughout the sugar belt of British Guiana, and to stress the importance of using every means available to remove it and to ameliorate its pernicious effects.

In an attempt to locate the magnesia strata, or to ascertain if there were such a thing, samples of soil through each six inches were taken to a depth of thirty-six inches. Two such series were taken upon one estate and two upon another. Calling these series *A*, *B*, *C*, *D*, the lime and magnesia percentages, soluble in a 1 per cent. solution of citric acid ("available" lime and magnesia) are shown in the following table :—

	A		B		C		D	
	Lime	Magnesia	Lime	Magnesia	Lime	Magnesia	Lime	Magnesia
1st 6 ins.	0·074	0·056	0·135	0·069	0·107	0·081	0·093	0·018
2nd do.	0·069	0·040	0·117	0·093	0·087	0·032	0·102	0·011
3rd do.	0·084	0·098	0·100	0·096	0·091	0·049	0·125	0·011
4th do.	0·056	0·013	0·078	0·044	0·107	0·143	0·113	0·013
5th do.	0·091	0·085	0·084	0·043	0·103	0·072	0·092	0·010
6th do.	0·089	0·022	0·025	0·074	0·144	0·076	0·084	0·009

There seems to be, however, little connexion between depth and quantity of magnesia, this latter probably varying with the fluctuations of the currents

of water which in past geologic periods brought the magnesium silicate (for it was originally evidently in this form) from the interior of the continent and deposited it in its present position. As the fields from which *A* and *B* were obtained had some dead cane, two samples of this were taken and analysed for lime and magnesia, yielding the following figures :—

		Per cent. Cane.	Per cent. Ash.
1st Sample	Lime	0·14	2·55
	Magnesia	0·86	16·06
2nd Sample	Lime	0·13	2·47
	Magnesia	0·84	15·67

The field from which series *D* was taken showed no signs of dead or dying cane, which was to be expected from the good lime-magnesia ratio shown throughout. The removal of the magnesia would be comparatively easy but for the impermeability of these stiff clays which retain it with great pertinacity.

All forms of ploughing to loosen the soil, and allow of the magnesia being leached out, are therefore highly desirable, as well as the incorporation of all forms of organic matter, for the production of humus and the promotion of this same loosening and leaching effect. Obviously lime, to maintain a satisfactory lime-magnesia ratio, is very necessary ; probably it should be applied whenever analysis does not show twice as much lime as magnesia.

Also, if applied in the form of hydrate, or tempered lime, it precipitates much of the magnesia as an insoluble and harmless compound. To summarize, if the small quantity of magnesia in the apparently harmless Epsom salt can cause death, then the magnesia diffused throughout these alluvial lands, to which attention is drawn, must be held accountable for innumerable disappointing yields from crops which in their early stages of growth gave promise of excellent returns.

The Queensland Sugar Crop of 1929.

According to the official report on the results of the Queensland sugar crop for the 1929 season, the final figures show that though the tonnage of cane (3,581,265) was less than estimated, the quantity of sugar made at 94 N.T. was 518,516 tons, or 10,184 tons more than the preliminary figure. This compares with 520,620 tons in 1928 which was the record. Thirty-five mills again operated during the year. The yields per acre are estimated to be 16·01 tons of cane and 2·32 tons of 94 N.T. sugar, while the average tons of cane required to make one ton of sugar were 6·91, compared with 7·18 in 1928. This tonnage of cane to sugar has gradually decreased from 9·44 in 1900 to 6·91 in 1929, this being due both to improvement in cane varieties and to higher efficiency in the mills. The consumption per head in Queensland is estimated at 120 lbs. Besides the sugar, there was produced 15,861,948 gallons of molasses ; of this some 5½ millions was sent to distilleries, over 4 millions was burnt, nearly 3 millions run to waste, and the rest fed to stock or used as manure. During the 12 months ending June, 1930, approximately 180,694 tons of sugar were exported direct from Queensland, valued at £2,194,245, on the basis of £12 a ton (export price). Previous statistics gave the value on the basis of the Australian price of about £26, so the latest figures are not strictly comparable with 1928-29 when 198,120 tons were exported at a valuation of £5,189,752.

English and Scottish Beet Sugar Companies.

Results of the Principal Undertakings for the 1928-29 and 1929-30 Seasons.

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In the table below are summarized the results of the operations of beet sugar companies in England and Scotland during the past season. The number of undertakings is thirteen and practically all of importance are included. Details of the United Sugar Company in which TATE & LYLE is interested cannot be given, as that undertaking regards itself as a private enterprise, though it participates in a public subsidy. The Second Lincolnshire Sugar Company, which was formed in 1928, and is controlled by the Lincolnshire Sugar Company, is not yet making any return to the parent concern. The principal groups are the Anglo-Scottish, of which Lord Weir is chairman; the Anglo-Dutch, with which is associated the Central Sugar Company, of Amsterdam; and the Anglo-American, in which is interested the Dyer Company, of Massachusetts.

Figures of each individual undertaking have been reduced to a comparable basis, as far as feasible, so that the results of the past season may be set readily against those for the previous year. Trading profit is struck before allowing for interest and taxation. Whether the figures are given before or after allowing for depreciation is indicated. Net profit is struck after deduction of the charges mentioned above, but before allocations to general reserve and provision for such special purposes as preliminary expenses. The Government subsidy is included in both trading and net profits, but in their accounts the companies do not set forth the amounts separately. It is impossible to form any correct judgment of the operations of the companies individually without knowing the relation the subsidy bears to disclosed profits.

COMPANY.	Paid-up Capital.		Loans.		Trading Profit.		Net Profit.		Reserve Appropriation.		Depreciation Allowance.		Ordinary Dividend.		Carry-Forward.	
	1928-29	1929-30	1928-29	1929-30	1928-29	1929-30	1928-29	1929-30	1928-29	1929-30	1928-29	1929-30	1928-29	1929-30	1928-29	1929-30
ANGLO-SCOTTISH GROUP—	£	£	£	£	£	£	£	£	£	£	£	£	Per Cent.	Per Cent.	£	£
Anglo-Scottish Beet Sugar Corp ..	442,900	442,910	688,700	669,679	*b* 55,400	*b* 98,220	10,700	21,452	nil	nil	20,000	47,000	nil	nil	*j* 97,800	*j* 117,518
Second Ang.-Scot. Beet Sugar Cp...	240,500	240,500	972,800	820,078	*ib* 37,800	*a* 31,492	*g* 3,000	*g* 11,738	nil	nil	nil	35,000	nil	nil	*j* 18,500	*j* 5,041
West Midland Sugar Company ..	180,000	180,000	109,200	94,200	*b* 67,900	72,281	33,600	28,910	nil	nil	19,000	25,000	*c*10	*c*10	51,600	62,475
ANGLO-DUTCH GROUP—																
Ely Beet Sugar Factory	450,000	450,000	nil	nil	*a* 168,200	*a* 180,307	115,232	126,490	59,000	70,240	102,600	100,000	*c*12½	*c*12½	nil	nil
English Beet Sugar Corporation ..	500,000	500,000	nil	nil	*a* 177,600	*a* 174,314	103,800	150,318	3,800	50,318	25,000	36,623	*c*20	*c*20	nil	nil
Home Grown Sugar	125,000	125,000	50,900	50,000	*b* 18,600	*b* 41,093	*g* 14,400	11,363	*k* nil	8,238	25,500	25,695	5	5	nil	nil
Ipswich Beet Sugar Factory......	400,000	400,000	nil	nil	*a* 67,800	*a* 86,645	50,600	61,396	600	11,396	20,000	35,000	*c*12½	*c*12½	nil	nil
King's Lynn Beet Sugar Factory..	450 000	450,000	54,000	35,000	*a* 67,600	*a* 99,523	36,800	51,787	800	6,787	20,000	42,000	*c*8	*c*10	nil	nil
ANGLO-AMERICAN GROUP—																
Central Sugar Company	175,000	175,000	80,200	59,800	*b* 94,300	*b* 123,461	43,600	*l* 2,950	nil	40,000	20,600	65,000	*c*10	*c*15	69,600	6,287
Lincolnshire Sugar Company	332,500	332,500	*e* 367,800	*e* 336,670	*b* 46,000	*b* 76,025	11,300	48,847	nil	nil	11,000	16,200	*d*nil	nil	11,300	31,105
Yorkshire Sugar Company	196 900	196,874	150,000	155,968	*b* 36,100	*b* 41,759	10,800	8,037	nil	nil	9,000	15,000	nil	nil	2,100	10,106
UNATTACHED UNDERTAKINGS—																
British Sugar Manufacturers	348,100	348,130	297,700	309 381	50,000	*b* 46,537	27,600	15,537	nil	nil	27,600	31,000	nil	nil	*f* 59,500	*f* 43,995
Shropshire Beet Sugar Company	354,600	354,559	nil	30,000	*b* 72,900	*b* 91,493	33,100	26,493	nil	nil	15,000	65,000	*h*	*hh*	7,100	797

a After depreciation allowance. *b* Before depreciation allowance. *c* Tax free. *d* Nil on Participating Preference. *e* Including debentures for £175,000 issued as security for guarantee. *f* Debit balance. *g* Loss. *h* 6 per cent. on Preferred Ordinary. *hh* 10 per cent. less tax, on Preferred Ordinary, and 20 per cent. free of tax on Deferred Ordinary. *i* Including transfer from reserve no longer required. *j* Subject to directors' fees. *k* £17,500 withdrawn. *l* After charging investment depreciation, £28,125.

The Sugar Machinery Industry in Glasgow.

An Interesting Development.

Our readers may be interested to learn that the well known firm, Blair, Campbell & McLean, Ltd., Engineers, Founders and Coppersmiths, Govan, Glasgow, have still further extended their association with the sugar industry by acquiring the business, comprising the goodwill, drawings, and patterns, of the Harvey Engineering Company Ltd., of Glasgow, makers of sugar machinery and refinery plant. Blair, Campbell & McLean Ltd., were largely influenced in their decision to acquire this extensive business with a view to rationalizing the production of sugar and allied machinery and reducing manufacturing costs, which will undoubtedly prove of considerable advantage to users of sugar and allied machinery throughout the world.

With the object of identifying the Companies above referred to, Blair, Campbell & McLean, Ltd., will in future adopt the title :—

BLAIRS LIMITED, incorporating :—
Blair, Campbell & McLean, Ltd.,
Harvey Engineering Company,
(formerly McOnie Harvey & Co. Ltd.),
and A. & P. W. McOnie,

and their address for correspondence will be Blairs Ltd., Glasgow Engineering Works, Glasgow, S.W.1.

We understand that the control and management of the Company will continue exactly as before, no changes other than in the title of the Company having taken place.

The following brief resumé of both Companies will, we feel sure, prove of interest. Blair, Campbell & McLean, Ltd.. were established in the year 1838, and carried on an extensive business manufacturing sugar plant which, apart from the milling plant, at that date was principally composed of copper, and the Company rapidly gained a leading position due to the excellence of their work, which position they have maintained to the present day. Their activities now embrace a wide field of engineering; and equipment of great variety, constructed in iron, steel, bronze, copper, aluminium, non-ferrous and acid-resisting metals including stainless steel, for a diversity of purposes is manufactured for important industrial undertakings throughout the world. A list of the industries for which the Company caters, or of the specialized plant manufactured, would be very lengthy, and we will confine ourselves to stating that apart from the manufacture of sugar machinery and refinery plant, which department of the business has received special attention for many years, Blair, Campbell & McLean, Ltd., are noted for the manufacture of equipment for Distilleries, Breweries, the Chemical and Allied Industries, and Food Products, Artificial Silk, Tannin Extract Makers, and many other kindred industries.

Their original works were situated in Scotland Street, Tradeston, but the business was transferred in 1904 to Woodville Street, Govan, new and commodious works then being built. As the result of an ever increasing business these works have from time to time been extensively enlarged and now occupy considerable area and rank as one of the foremost and best laid out and equipped in Glasgow.

Messrs. Blair, Campbell & McLean, Ltd., acquired in the year 1917 the sugar machinery business of A. &. P. W. McOnie, a company of excellent repute among sugar planters and producers throughout the world in their day. The founders of this business were two brothers Andrew and Peter McOnie, who prior to this date had been intimately connected with the sugar

industry, as Andrew McOnie was an original partner of the firm of W. & A. McOnie, and a brother-in-law of David and James Blair, the principals of Blair, Campbell & McLean, Ltd. In the year 1851, William McOnie, subsequently a Lord Provost of the City of Glasgow, along with his brother Andrew, the father of Andrew and Peter McOnie mentioned above, established the sugar machinery business which ultimately became the Harvey Engineering Company Ltd., and it is not without interest to record the sequence of events which took place.

The business established by William McOnie, afterwards Sir William McOnie of Ballochneck, and his brother in 1851 was designated W. &. A. McOnie and their works were erected at the corner of West Street and Scotland Street where the Harvey Engineering Company's works now stand; subsequently on the retirement of Andrew McOnie and his son, the title of the Company was changed to W. &. W. McOnie. In the year 1888 Mr. Robert Harvey joined the firm and the title adopted then was McOnie, Harvey & Company, and again later, in 1904, the Harvey Engineering Company Ltd.

The past record of the Harvey Engineering Company Ltd., is one of which any Company should be proud, and the name of Harvey is well known to those who in the various parts of the world, where sugar cane is grown, are interested in sugar estates and sugar machinery. In their day the firm supplied many of the largest and best equipped sugar factories and refineries in all parts of the world and justly earned the high reputation they long held for the reliability of the machinery manufactured by them.

While Blair, Campbell & McLean Ltd's connexion with the sugar industry was increased by the acquisition of the business of A. & P. W. McOnie in 1917, they had prior to this supplied and equipped numerous complete sugar factories in various parts of the world and since then many complete plants and B.C.M. mills manufactured at their works in Govan have been installed. Now, by their acquisition of the business of the Harvey Engineering Co. Ltd., Blairs Ltd. intend that the high reputation for efficient and substantial machinery gained by that company shall be effectively maintained by their successors, who will naturally be prepared to deal with all business for replacements, repairs and extensions to existing Harvey equipment. In addition Blairs Ltd. intend to continue building equipment to the Harvey Engineering Co. Ltd.'s designs, where clients so desire, and with this object in view have retained the services of certain of the technical staff previously employed by the Harvey firm.

With these added facilities and advantages, Blairs Ltd. are clearly laying themselves out to offer to the world-wide sugar producing interests useful service not only in the supply of equipment for producing raw and refined sugar, but also in the supply of plant for the utilization of by-products, such as alcohol, fertilizers, etc., from molasses, in which line of business they have had much experience. It may be added that Blairs Limited have resident engineers and representatives throughout the whole of the sugar producing world, whose services are always available for advice or assistance as required.

Mauss Filter.—A battery of 8 of these rotary vacuum filters has been in constant use on the filtration of the first carbonatation muddy juice at Mt. Edgecombe, Natal.[1] Advantages claimed for the machine in comparison with the plate-and-frame filter are economy in labour and cloth, cleanliness and decreased sugar losses. These filters work at their best on thickened sludge and should not be considered as filters of high juice capacity, but rather as sludge dryers and sugar recuperators.[2]

1 J. Rault: Report on Clarification and Filtration, South African Sugar Technologists' Association, 1929, page 46. 2 See *I.S.J.*, 1928, 217.

Publications Received.

Recent Advances in Analytical Chemistry. Vol. 1 : Organic Chemistry. Editor : C. Ainsworth Mitchell, M.A., D.Sc., F.I.C. (J. & A. Churchill, London). 1930. Price : 12s. 6d. net.

Mr. C. L. Hinton, Chemist-in-Charge of the Analytical Department of the British Association of Research for the Confectionery Trades, London, has written the section on " Sugar Analysis " in this volume dealing with recent progress made in the analysis of important commercial products. He has made a strikingly interesting and thorough review of the present position of this branch of work, which those who desire to be abreast of the knowledge of this particular subject would do well to study. In his preface he points out that the currently used methods of sugar analysis are very much matters of habit, and that new methods must have very special attraction in order to displace the older and less exact. His survey should assist by bringing out the points of recent advance that can be most usefully added to or displace existing methods, and by placing some of the newer independent methods in correct relation to the old.

Mr. Hinton concludes his review by speculating on the trend of sugar analysis in the future. It seems certain, he says, that in the near future there will be a displacement, perhaps a complete ousting, of gravimetric methods, the simplicity of the newer volumetric and colorimetric processes being bound to make great headway. Physical methods will be extended, since these best meet modern conditions demanding speedier results. Increasingly convenient apparatus will be developed for *pH* work, conductometric determinations, spectrophotometry, and electro-titrations. Electrical illumination for the polarimeter and colorimeter will be followed by the p[illegible]fecting of the photo-cell f[illegible]uch light-transmitting instruments. The ult[illegible]y into sugar work, and perhaps the X-ray tub[illegible], standardization will have the effect of sweepin[illegible] and parochial methods still scattered up and down lab[illegible]parts of the world.

The Elements of Fractional Distillation. Clark S. Robinson. Second Edition. (McGraw-Hill Publishing Co., Ltd., London). 1930. Price : 15s. net.

Young's " Fractional Distillation," while a classic of its kind, has to do almost entirely with the aspects of the subject as viewed from the chemical laboratory. Until the publication of the present work in 1922, there was no work available for the engineer and plant operator. But this book, explaining as it did the principles involved in such a way as to make it possible to apply them to the particular problem in hand, at once established a place for itself in the literature of distillation. Now a second edition has been demanded. Its elementary character has been retained, but a good deal of material has been added (more particularly in dealing with the petroleum industry). As a guide to the principles of fractional distillation, it remains a valuable contribution, the study of which will be found by many interested in that branch of industry amply to be repaid.

The Chemists' Year Book, 1930. Edited by F. W. Atack, D.Sc., F.I.C. (Sherratt & Hughes, Manchester). 1930. Price : 21s.

The " Chemists' Year Book " has now been in existence for 15 years, during which period it has been gradually expanded and revised, and now comprises a guide which may be described as being indispensable to the chemist engaged in works or laboratory. One of its special features is the inclusion of the latest analytical methods in the technical sections, valuable to the trained chemist who may be suddenly called on to attempt analyses of a type with which he may not be currently familiar. This latest edition is brought well up-to-date, but it would now seem to be time to include a section dealing with the commercial analysis of sugar and of saccharine products generally.

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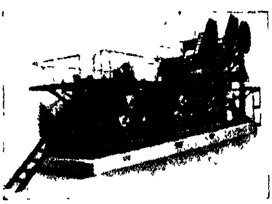

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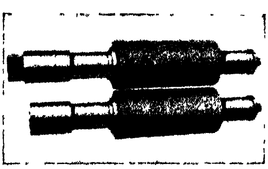
Built record for three-roller mills or in tandems of six, much, but this has not been orthe without a enormous and may reach 1,125,000 met ings with metal percentage was estimated at improved hydraulic captimated sugar per hectar h removable cylinder having on. The 1929-30 crown wheels with specially designed teeth to give maximum variation of roll centres. Accessibility and interchangeability of parts a particular feature. Used by leading sugar producers in all parts of the world.



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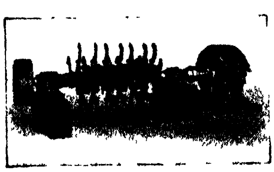
Made of a mixture of metals, which produces a hard iron of very open grain, demonstrated to be the most satisfactory by over fifty years' experience and hundreds of rolls in successful operation. Texture and quality of iron in roll shells a factor in obtaining high extraction and tonnage. Method of construction a positive prevention of shells becoming loose on the shaft.



Farrel Revolving Cane Knives:

For shredding and cutting any kind of cane, making a compact blanket which provides more uniform feed to the crusher. Made with specially shaped knives having serrated edges (patented) which increase shredding action. Expand mill capacity and raise sucrose extraction. Arranged for electric motor, engine or belt drive. Maintenance cost is negligible.

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NEW RECORDS FOR PRODUCTION AND PRECISION ARE MADE ON FARREL-BIRMINGHAM MACHINES.

Brevities.

ANGLO-CEYLON & GENERAL ESTATES.—At the annual meeting of the Anglo-Ceylon & General Estates Ltd., Sir Edward Rosling stated that the Mauritius sugar estates of the Company had achieved a loss for the year of some £9000, the net price for the sugar being £11 per ton as compared with £12. 16s. in the previous year; this on a crop of 17,160 tons of sugar. As for the tea crop in Ceylon, the principal tea producers in India, Ceylon and the Dutch East Indies had entered into an agreement to reduce crops by certain percentages. The tea market was suffering from a plethora of common teas and with the proposed restriction, which will chiefly affect this class, there were good grounds for expecting an all-round improvement. As for sugar Sir Edward Rosling remarked that it was too much the plaything of politicians.

SOUTH AFRICAN SUGAR CROP.—According to our Durban contemporary, the estimates of the current South African sugar crop are now in the neighbourhood of 360,000 short tons and a total crop of 375,000 tons is considered highly probable. Since the current consumption of the Union is approximately 204,000 tons, this would leave a balance of 171,000 tons to be exported or otherwise dealt with, representing approximately over 45 per cent. of the crop. Last season's actual output was 298,635 short tons, so if the present estimate is reached, the increase in the one season will be no less than 76,365 tons. Inland price levels are being maintained at £23 for refined; but when export prices, manufacturers' rebates and other incidentals are taken into account, the average price is not going to pan out much above £15 per ton.

THE FRENCH BEET CROP.—The *Journal des Fabricant de Sucre* states that this has been one of the rainiest summers on record for the French sugar beet crop. A fine September would have redeemed much, but this has not been forthcoming. Nevertheless the crop is spoken of as enormous and may reach 1,125,000 metric tons of refined. At mid-September the sugar percentage was estimated at 16·73, the weight of roots per hectare 31 tons, and the estimated sugar per hectare 5·195 tons which is above the ten years' average of 4·456 tons. The 1929-30 consumption in France has reached 937,000 tons, as compared with 918,000 tons in 1928-29 or an increase of 2·29 per cent. The round million tons has still to be reached, and the achievement is not rendered easier from the fact that the price of sugar remains high, owing to the internal tax on it.

FORMOSA: SUGAR PRODUCTION.—The Department of Overseas Trade reports that the first official forecast of sugar production for the 1930-31 season in Formosa has just been published. The output of centrifugals (including "plantation white") is placed at 13,067,667 piculs (771,645 tons), and that of brown sugar at 169,903 piculs (10,033 tons), making a total of 13,237,570 piculs or 781,678 tons. The above estimate envisages a decrease of 270,481 piculs (15,972 tons) on the actual production realized in 1929-30. The decrease may be ascribed to a reduction of 8709 Ko[1] (20,873 acres) in planted area. The estimated yield of sugar per Ko, however, is placed for this season at 145·75 piculs, as against 135·72 actually realized last season, average sugar content being taken at 12·72 per cent. in each case. This higher estimate is based on the continued spread of better varieties of cane.

THE PORTO RICO SUGAR CROP.—Information to hand from Porto Rico indicates that the forthcoming sugar crop will be considerably reduced from earlier estimates and in all probability will be somewhat lower than this year's total of 886,000 tons. The rapid distribution of the POJ 2878 seedling canes and the remarkable results achieved with regard to their yield (15 tons extra of cane per acre and 2 tons more of sugar than with BH 10(12) made it reasonable to assume that a million tons was to be produced; but two serious misfortunes have cropped up to prevent it. One was an extremely severe drought from January to the beginning of September, said to be the worst experienced in the past fifty years. The other was the very recent discovery of "gummosis" infection in POJ 2878. Up to recent date nothing had been known as to the susceptibility of that variety to such a disease. It is hoped that it will be confined to a small region, as at present is the case.

[1] The Ko, or Chô, is virtually equivalent to the hectare.—ED. *I.S.J.*

SOUTH AFRICA TACKLES THE SUGAR DUMPING PROBLEM.—News to hand from South Africa indicates that although the import duty on sugar entering the Union was raised to 12s. 6d. per 100 lbs. by the new Tariff Act passed last May, the Government still retains the power to impose anti-dumping duties additional to the basic rate of import duty, and is credited with the intention of protecting the local market fully against threatened importations of sugar offered at prices below the economic cost of production. In this event, any attempt on the part of European beet sugar manufacturers to dispose of their surplus stocks at low prices on the South African market seems doomed to failure. As a matter of fact, the invasion of this outside sugar into that market has dropped to zero of late months. Imports of foreign sugar for the months of May and June amounted to only 435 tons. During July not a single ounce entered South Africa.

SIR J. L. HULETT & SONS LTD.—The annual Report of the leading Natal sugar firm shows that for the year ended April 30th last the net profit amounted to £45,922, as compared with £159,682 in 1928-29. A dividend of 6 per cent. (as againt 15 per cent.) is being paid. The quantity of sugar manufactured during the season was 77,973 tons, which was rather more than 5 per cent. below the previous year's output. This crop was the output of only three of the mills, viz., Darnall, Amatikulu, and Felixton, Tinley Manor being closed down with the object of making as full use as possible of the large capacity of the Darnall mill and thus reducing the cost of manufacture. The net return of the mill per ton of 96° raw sugar was £12. 14s. 8d., as compared with £15. 8s. 5d. for the previous year. The present crop is expected to be the largest ever produced, being estimated at 95,000 tons and will be dealt with by the three mills above referred to.

ACREAGE UNDER SUGAR BEET IN GREAT BRITAIN.—Preliminary statements of the acreage under crops on 4th June, 1930, issued by the Ministry of Agriculture and Fisheries and the Department of Agriculture for Scotland show a large increase in the acreage under sugar beet for this year. The figure now published is 348,100 acres compared with 230,500 for last year, an increase of 117,600 acres or about 51 per cent. This is the largest figure yet recorded for the beet crop in this country. The latest figures of the acreages in Great Britain under the crop in previous years, during which the beet sugar subsidy has been paid, have been as follows :—

Year.	Acreage.	Year.	Acreage.
1924	22,637	1928	178,047
1925	56,243	1929	230,553
1926	129,463	1930 (preliminary statement)	348,100
1927	232,918		

At the end of August the growing sugar beet was considered generally satisfactory but a heavy crop was not indicated. More sun was needed to obtain a good sugar content.

DEATH OF MRS. G. L. C. HOWARD.—The death has to be recorded of Mrs. Howard, wife of Albert Howard, C.I.E., the director of the Institute of Plant Industry in Indore, India. She was herself a scientist, having graduated with first class honours in Natural Science at Cambridge, and her work is bound up inseparably with that of her husband, who after starting his career as Mycologist in the West Indies went to India as Imperial Economic Botanist at Pusa. Apparently soon after their marriage, a post was created for her as " Second Imperial Economic Botanist " at Pusa (in 1910) and thereafter the two devoted themselves to the study of various crops in succession and wrote valuable monographs on various matters connected with Indian agriculture. Since these memoirs and bulletins were almost all published under their joint names, it is not possible to say what part each took ; but generally speaking Mrs. Howard was regarded as more interested in genetics and heredity than in the practical surroundings of the crops. Of late years both have been attached to the Institute of Plant Industry in Indore and have gradually diverted their attention to cotton. Mrs. Howard's last distinction was to be invited to act as President of the Agricultural section of the 16th Indian Science Congress, held in Madras in 1929, when she delivered an illuminating address on " The Improvement of Plants " which has received notice in our columns.[1]

[1] *I.S.J.*, 1929, 487; 1930, 123.

Review of Current Technical Literature.[1]

COLLOIDS IN GRANULATED SUGAR. **C. F. Bardorf.**[2] *Ind. & Eng. Chem.*, **1930, 22,** No. 8, 907.

The question of colloids (highly dispersed cane wax) in granulated sugar was brought to the attention of the author by the claim of certain soft-drink manufacturers that some granulated sugars tend to coagulate the flavouring extract used in the preparation of aerated beverages. This coagulation becomes apparent in one of two ways : the bottled product loses its brilliancy, or some of the extract forms a flocculent collar on the surface of the liquid. Strange to say, granulated sugars of superior quality, from a refiner's point of view, have proved more troublesome in this respect than those of admittedly inferior quality. For the purpose of rapid comparison, granulated sugars were subjected to three tests : (1) by observation of the brilliancy and colour of the crystals under a daylight lamp, (2) by observation of a 50 per cent. solution in a white glass tube (Nessler, ¾ in. × 18 in. ; depth of liquid, 12 in.), and (3) by a percolation test. The percolation test was made in a 1 in. × 4 in. glass tube. The tube is filled with the sugar to be examined and slightly tapped to settle the grains, and then 5 to 10 ml. of cold distilled water are dripped slowly on the sugar. As the water percolates through the crystals, it carries with it any colouring matter and also much of the colloidal wax. When the water has penetrated about 2 in. (5 cm.) of the crystals, a ring is formed in the tube at the bottom of the descending column of water. This ring may be light yellow, or brownish, and when colloids are present to an appreciable extent, will have a decidedly gray tinge. From the character and intensity of the ring a fair estimate can be made of the relative quality of the sugars under examination. Though admittedly crude, this method does enable the refiner to establish the variation in the so-called standard granulated sugars.

With the co-operation of an aerated beverage manufacturer, 10 samples of granulated sugar were tested by preparing simple syrups and then adding an emulsified preparation which had previously been known to separate from the finished beverage. The usual trade bottles were filled with properly diluted extract and syrup and set aside for observation. After 2, 3, or 4 days a record was made of the condition of the beverage with respect to the absence or presence of coagulated or flocculated extract. Remarkable differences were to be observed : some bottles showed distinct rings of closely packed coagulated material while others exhibited loose flocculations. In the accompanying table the quality of the sugars is indicated in accordance with the three tests and degree of flocculation, *a* indicating little or no flocculation ; *b*, intermediate ; and *c*, the maximum.

Sample	Test 1	Test 2	Test 3	Turbidity	Ash Per Cent.	Flocculation.
1	*a*	*a*	*a*	*a*	0·0030	*c*
2	*a*	*a*	*a*	*a*	0·0076	*b*
3	*a*	*b*	*b*	*b*	—	*b*
4	*b*	*b*	*b*	*c*	0·0080	*a*
5	*b*	*b*	*b*	*c*	0·0136	*a*
6	*b*	*b*	*b*	*c*	0·0164	*c*
7	*c*	*c*	*c*	*a*	0·0104	*a*
8	*a*	*b*	*a*	*a*	0·0020	*b*
9	*a*	*a*	*a*	*a*	0·0050	*a*
10	*a*	*b*	*b*	*b*	0·0074	*c*

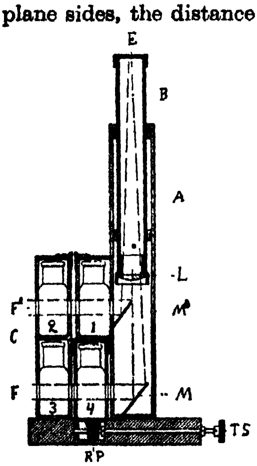
A critical examination of the table throws little light on the cause of flocculation. Since sugar of inferior quality—for example, samples 4 and 5—proved satisfactory, samples 1 and 2 were found unsatisfactory. Again, the average percentage of ash of sugars classed as *a*, under flocculation column, is 0·010, while classes *b* and *c* contain, respectively, 0·005 and 0·009 per cent. of ash. Sugars, 1, 2, 6, and 10 had been refined from Natal raws ; 4 and 5 from Cubans, and 8 and 9 from British West Indian raws. A second lot of sugar No. 7 was subjected to another experiment and test and fell into the *c* class under turbidity, but nevertheless maintained its status as

2 St. Lawrence Sugar Refineries, Montreal, Canada.

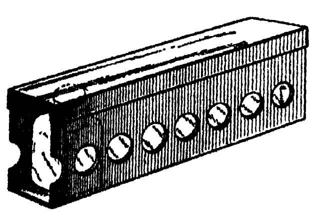
a in flocculation column. So far as this preliminary investigation has gone no conclusive data have been found to suggest the cause of flocculation. General excellence of a sugar does not guarantee such non-flocculent tendencies in the products. Indeed, from the observation of samples 1, 2, 8, and 9 perfectly satisfactory beverage products would be expected. But since all granulated sugars (No. 2 excepted) refined from Natal raws fall into the *c* class as regards floc production, it is to be inferred that the colloid dispersion in this sugar has some adverse influences. That the nature of the dispersions, rather than the quantity of colloids, is a determining factor is suggested by the fact that sugars 4 and 5 gave the most turbid solutions of the ten lots examined and, strange to say, produced no flocculation. Finally, samples 1, 2, 3, and 9 are to be regarded as very fine examples of standard granulated and are fully up to the best commercial products of their class.

MULTIPLE STANDARD COLORIMETER FOR *pH* DETERMINATIONS. **S. L. Leiboff.** *Ind. & Eng. Chem.* (*Anal. Ed.*), 1930, **2**, No. 2, 194.

This colorimeter was especially designed for matching colours of unknown solutions where a single standard cannot be used, particularly in colorimetric hydrogen-ion determinations of wide range. Usually such determinations are done in test-tubes in a block comparator where the tubes are placed side by side and the colour differences observed. In the colorimeter here described all the standards are contained in small, rectangular bottles of uniform size with two opposite parallel plane sides, the distance between which is uniform in all the bottles.[1] This allows the passage of light through equal depths of solution. The standard bottles are placed close together in a black rectangular box (lower figure). This box contains circular fenestrae on two opposite sides parallel to each other. Each bottle fits snugly between a pair of fenestrae, thus allowing the light to pass through a uniform depth of solution with all the standards. The upper figure shows the colorimeter with the standards in place. It consists of compartment *A*, which contains two mirrors, *M* and *M'*, placed at an angle of 45° and parallel to each other. Mirror *M'* is half the size of mirror *M*. The cylinder *B* carries a magnifying lens, *L*, and an eyepiece, *E*. To facilitate the reading the reading tube itself may be sloped, with the mirrors tilted at an appropriate angle.



For the determination of *pH* the following arrangement is used: In compartment *C* are placed the unknown standards and compensators. Bottle 1 contains the unknown solution with the appropriate indicator. Bottle 2 contains distilled water. Bottle 3 contains the unknown solution, but without indicator, to compensate for cloudiness and colour of the unknown. The box containing the standards is placed at 4 and is moved along the stage horizontally by means of a rack and pinion, *RP*, with the thumb screw *TS*. This box is moved along on the stage while the operator is looking through the eye piece until the closest match is obtained between the standard and the unknown. The light passing through the fenestrae *F* and *F'* is reflected upward by the mirrors—mirror *M* covering one-half of mirror *M*, and produces, when viewed through the eyepiece, the effect of a circle, one-half representing the standard and the other half representing the unknown. Comparisons may be made by artificial light by placing a few sheets of tissue paper between the source of light and the colorimeter in order to diffuse the light.

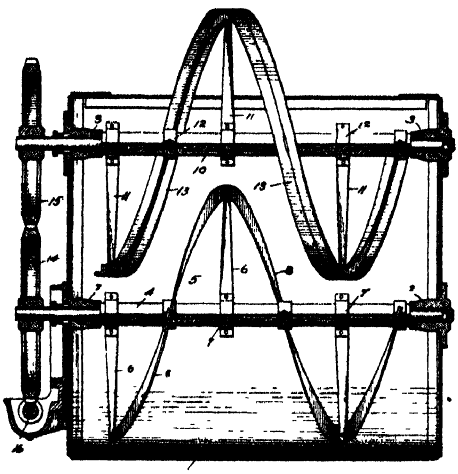


[1] Very suitable bottles are Nos. 31,190 and 31,192, Eimer & Amend Catalogue, 1927, p. 705. These bottles are used for spectroscopic work and are inexpensive.

Review of Current Technical Literature.

Improved Method of Cooling and Curing Massecuites. **R. C. Pitcairn.** *Sugar News*, 1930, 11, No. 4, 180-186.

In 1925-26 it was noticed in the Hawaiian-Philippine Co.'s plant, P.I , that a single scroll helix crystallizer if only half filled led to a reduction in the time of cooling of about 50 per cent. In 1929 Mr. W. G. Hall suggested super-imposing one helix on another to obtain the same result for a full crystallizer ; and the advantages as to economy of space and equipment were at once obvious. A series of comparative tests were made on Crystallizer-A with superimposed helix, and Crystallizer-B with the single submerged helix, and were run for two months, under identical conditions as to quality of massecuite and temperature conditions. In connexion with the group of strikes put through "A," the average gravity purity of the resultant molasses from those strikes showing the higher temperature at the time of centrifuging, namely 100°F., was lower than the a.g.p. of the molasses from those strikes that were dropped into the centrifugals at an average of 96°F. Also, it was lower than the a.g.p. of the molasses from those strikes put through "B" even though the average temperature of the massecuites discharged from "B" was 92°F. One seems justified, therefore, in assuming that it is not necessary to cool crystallizer goods to the same point as has been customary in past crystallizer practice. From actual tests run over a period of 60 days under factory working conditions it was shown that more than three times the volume of massecuite could be cured and cooled in "A" than in "B" in the same length of time and with the same results. The time of curing and cooling to get the same results was reduced from 152 to 42 hours or approximately 72 per cent. It would appear that the presence of entrained air in the massecuite after curing and at the time of centrifuging, and the temperature of the massecuite at the time of purging, have decidedly opposite effects on the viscosity and purging qualities of the same ; but it was found that air-filled massecuites could be purged at 100°F. with as good mechanical results as air-free massecuite at 92°F., while giving the same exhaustion to the resultant molasses. By the use of the superimposed helix, a more thoroughly controlled mix of the massecuite is secured as well as a reduction in the water-content during the process of crystallization, which goes on with a more complete use of all the working surfaces of the crystals than in the old type of water-jacketed, water-tube, or ordinary U-shaped crystallizers. A final point is that the formation of false grain during the time the massecuite was in "A" was largely obviated, due to the same cause, namely, the more even conditions of temperature and saturation.



Sampling of Cane in the Field. **J. G. Davies.**[1] *Memoirs of the Imperial College of Tropical Agriculture, Trinidad ; Sugar Technology Series, No. 3.*

Sub-sampling Cane Samples.—It is general practice in the British West Indies to sample a field of cane by cutting down one or more stools, and sub-sampling the sample so obtained ; but so far figures dealing with the "standard error" of any method of sub-sampling do not appear to have been published. In taking up this matter, the following methods of sub-sampling were examined by the author : (1) by quadrants, in which each individual cane of the sample is cut through its entire length into four approximately equal parts ; (2) by halves, in which each individual cane of the sample is cut through its entire length into two approximately

[1] Assistant Sugar Technologist, Imperial College, Trinidad.

equal parts ; and (3) by thirds, in which the top of one cane is used, the middle of the next, and the bottom of the next. One complete stool was taken to represent a sample, which was then sub-sampled by each of the above three methods, put through a mill, analysed, and the "standard error" calculated.[1] Summarizing the results of the tests for the sucrose per cent. cane, the standard error of all sub-samples from the mean of their stool averaged out for the three methods as : (1) 0·259 ; (2) 0·349 ; and (3) 0·768. Hence there is no significance between the standard errors of methods (1) and (2), but a significant one between these and No. 3. Method (1) is therefore suggested as suitable for use in sub-sampling the samples from an experimental plot ; No. (2) for the ordinary routine analysis, e.g., in determining the degree of ripeness of a field ; and No. (3) the most rapid, only for a very rough estimation.

Sampling by the Stool.—In Trinidad a field is sampled by cutting a complete stool, instead of separate canes from different stools ; but the points that arise when this procedure is adopted are : (*a*) the sucrose variation from stool to stool ; and (*b*) the standard error of samples consisting of varying numbers of stools collected at random. In investigating these questions, 96 stools were collected at random from a 1-acre field, each being sub-sampled by the quadrant method (above), weighed, ground, and analysed. The results obtained showed 8·62 and 14·28 as the lowest and highest sucrose per cent. cane, that is a considerable variation from one stool to the next. The standard error of the population was fairly high, viz., 1·283 ; but the standard error of the mean of the 96 stools was small, showing that a sample of this magnitude gives a very fair basis to work on. It was calculated that 28 stools per acre would have to be collected to give a standard error of 0·50 ; 15 for 0·75 ; nine for 1·00 ; and four for 1·80 per cent. Another observation was that those stools collected from drain rows were significantly lower in sucrose content than those collected from rows between drain rows and middle rows, and the stools collected from these "between" rows were lower than those from the middle rows. This paper, therefore, demonstrates a method enabling the sucrose content of a field to be determined with a known degree of accuracy. It is recognised that slightly increased laboratory expenditure will thus be necessitated, but the additional sugar recovered will leave an appreciable margin of profit in the end.

EFFECT OF HUMIDITY ON THE DETERIORATION OF RAW SUGAR ON STORAGE. **R. H. King[2] and D. Suerte.** *Contribution No.* 660 *of the Sugar Technology Division, College of Agriculture, University of the Philippines* ; *Sugar News*, 1930, **11**, No. 8, 434-448.

During the present period of excessive production, the problem of storing sugar with a minimum loss of sugar becomes an important one. An investigation has been undertaken using Philippine raws and refined in order more particularly to determine the sucrose loss under various conditions, especially relative humidity. Sugars were kept in humidity chambers at a constant temperature of 27·5°C. during varying periods of time, at the end of which they were analysed. On the average all sugars showed no deterioration at a relative humidity of around 68 per cent. Below this point they gained in sucrose due to the removal of water ; but above it sucrose was destroyed, especially above 84, when the deterioration was exceedingly rapid. This considerable deterioration does not occur throughout the entire contents of the sack, being (as one would expect) least in the interior. Observations were made of the number of micro-organisms per c.c. under the different conditions. In general there occurred no increase in organisms up to 70 per cent. humidity during any length of exposure ; but above 75 all sugars develop deteriorating organisms at practically the same rate if sufficient time be allowed. Their development appears to follow a geometrical relationship. Another point investigated was the effect of humidity on the caking, known to be due to the presence of a gum of indefinite composition, dry

1 "Standard error" was : $\sqrt{\text{Variance}}$; and the Variance : $\frac{(\text{Sum of Deviation})^2}{\text{Degrees of Freedom}}$ A full explanation of these statistical terms is given by MASKELL in *Tropical Agriculture*, V, No. 12, 306-309.

2 Professor of Sugar Technology, College of Agriculture, University of the Philippines.

at a low moisture content, and extremely sticky when more water is present. When yet more water is present, the gum becomes colloidal, and loses its adhesive or sticky property. Caking of all sugars took place below 70 per cent. relative humidity; at 75 per cent. it was particularly apparent; but at a greater humidity, viz., 80 per cent. no difference was noted between samples, all being moist and loose. Sanitary conditions of centrifugals, especially clean floors and wash-water, and general mill and boiling-house sanitation will reduce contamination, but maintenance of humidity inimical to micro organisms will prevent loss. The deterioration factor at the time of sacking (moisture divided by 100—pol.) is not a measure of the possible deterioration under tropical and sea-side storage conditions. Equally worthless is the "count" of micro-organisms. Essential features of the construction of a sugar warehouse to keep raw sugar for a considerable period without deterioration are: Elimination of draughts; adequate soil drainage; impermeable floor; economic piling and unloading; and maintenance of constant humidity. Details of constructions of such a building were given in the Commitee Reports of the Philippine Sugar Association for 1924, and are exceedingly exact. Storage houses built under this plan keep raw sugars for a considerable period without deterioration.

ALCOHOL MOTOR FUEL MIXTURES: ADVANTAGES AND DISADVANTAGES. **W. Ostwald,** *Chemiker Zeitung*, August 20th, 1930.

Liquid fuels containing alcohol differ in certain important properties from the hydrocarbon fuels for which the ordinary internal-combustion engine is designed. It cannot be said, however, that they are less suitable for the purpose in view, and they possess, in fact, certain advantages. Difficulties may arise in changing over from petrol to alcohol mixtures, and one of the worst of these is due to the property of alcohol mixtures of loosening rust and dirt and depositing it at the lowest point of the fuel system, so that stoppages may occur when the power alcohol is used for the first time. Corrosion is not set up by power alcohol, as it is by mixtures containing methylated spirit. Whilst petrol generally deposits dirt in a moist condition which assists its elimination, sludge from a power alcohol mixture is dry, so that special arrangements have to be provided for its collection. Alcohol mixtures have great solvent power for varnishes, etc., so that corresponding care has to be taken to avoid spillages on the paint-work. The greatest difficulty, however, is caused by the tendency of power alcohol to separate into its components if it becomes wet with water. Power alcohol is a ternary mixture, in which the alcohol serves to maintain homogeneity in a mixture of hydrocarbons and water. The stability range of such mixtures is very narrow, both as regards concentrations and temperature. On the road, a turbidity of the fuel will cause little trouble, as the vibration will keep the moisture more or less uniform, but during a long stop the alcohol-water phase will collect at the bottom of the tank, the engine will be impossible to start, and the only remedy is to drain the whole fuel system. By using a petrol rich in unsaturateds and aromatics, and a high-percentage alcohol, this difficulty can be minimized to some extent, in that mixtures can be obtained which will take up 2 per cent. of water without separating into two phases. The worst trouble will occur in changing over from petrol to power alcohol, as most petrol systems contain "dead spots" in which water accumulates undetected until the sensitive mixture is run in. Another type of difficulty will arise with the widely-used two-stroke engine, with which the lubricating oil is often mixed with the fuel, as the oil acts as a precipitant towards power alcohol. In addition, engines are generally more difficult to start on power alcohol, especially in cold weather. The advantage of power alcohol lies particularly in the clean way in which it burns, so that carbonization is minimized. In addition, such alcohol is to some extent an "anti-knock," so that an engine will run more smoothly on power alcohol than on petrol, whilst the power alcohol will not dilute the lubricating oil to the extent which occasionally happens with petrol. The lower calorific value of alcohol is scarcely noticeable in practice on account of the above advantages. Since August 1st, 1930, between 10 and 15 per cent. of the motor fuel used in Germany has been compelled, by law, to consist of a power alcohol mixture.

ERROR IN POLARISCOPIC MEASUREMENTS (DUE TO TURBIDITY). **H. K. Miller and J. C. Andrews.** *Ind. and Eng. Chem.* (Analy. Ed.), 1930, **2**, No. 3, 283. That accurate polariscope solutions require the use of perfectly clear solutions is common knowledge, though there is little information as to the extent of the error which may arise if this precaution is neglected. Figures are given for the specific rotation of turbid solutions of amino-acids in tubes of (*a*) 1 dm. and (*b*) 4 dm. One turbid solution read (*a*) 13·9 and (*b*) 11·4, and another (*a*) 15·8 and (*b*) 9·4, whereas the same reading should have been obtained for (*a*) and for (*b*). This in fact was the case for a clear solution of sucrose (1·0795 grm. per 100 c.c.), which read (*a*) 67·00 and (*b*) 67·00. —POLARIZATION OF RAW CANE SUGARS TESTED BY THE N.Y. SUGAR TRADE LABORATORY. **F. W. Zerban.** *Facts about Sugar*, 1930, **25**, No. 18, 438-440. A table shows for each year from 1910 to 1929 the polarization of samples from all sources undifferentiated as to origin. A second table shows the geographical classification for 1925 to 1929, as follows :—

	Number of samples; per cent. of Total				Average Polarization			
Year	Cuba	P.R.	Phil.	Misc.	Cuba	P.R.	Phil.	Misc.
1925	70·7	11·3	9·4	8·6	96·03	96·22	96·80	95·82
1926	72·5	10·0	7·5	10·0	96·04	96·39	96·79	95·86
1927	69·2	10·1	11·1	9·6	96·39	96·45	96·82	96·09
1928	64·9	12·1	12·9	10·1	96·39	96·29	96·86	96·07
1929	67·9	6·8	13·7	11·6	96·60	96·32	96·75	96·35

These figures do not quite represent the sugars imported into the U.S., since those imported from estates owned by the refineries are not analysed by the Laboratory, while some Cubans represent stored lots which are tested every time they are sampled for re-sale.——DECOLORIZING FOR POLARIZATION. **A. M. Schwedow,** *Zapiski*, 1929, **8**, 513 ; through *Centr. Zuckerind.*, 1930, **38**, No. 31, 901. To 50 c.c. of the normal-weight solution, one adds 1-12 drops of a 30 per cent. water solution of pyrogallic acid, followed by 0·2 c.c. of lead acetate to each drop of the former re-agent, after which the liquid is made up to 55 c.c., mixed, filtered, and polarized. The flocculent precipitate thus produced is very adsorbent towards the colouring matters, giving a filtrate which is never cloudy, as sometimes occurs with lead acetate alone. (This was tried out with beet products ; and it would be worth ascertaining if this favourable effect is confirmed with cane products also).—DATA ON "LA CARLOTA" CENTRAL, P.I., 1929-30. **H. Gifford Stower.** *Communicated to this Journal by the Central Azucarera de la Carlota, Negros Occ., P.I.* This factory again established a record for the Philippines,[1] details being as follows :—

Commencement of crop, October 28th, 1929 ; Termination of crop, March 23rd, 1930 ; Possible working days, 127 ; Days of 24 hours, 126·5 ; Days of 24 hours worked, 125·2 ; Average of hours worked per working day, 23·39 ; Average of hours worked per day of 24 hours, 23·45 ; Time lost due Factory, 12·02 ; Time lost due to want of cane, 19·35 ; Based capacity of mills, metric tons, 3760 ; Average milled per working day, metric tons, 3830 ; Average milled per day of 24 hours, metric tons, 3846 ; Average milled per 24 hours worked, metric tons, 3885 ; Total sugar manufactured, sacks of 57·5 kilos (126·8 lbs.) net, 1,120,622 ; Total sugar manufactured, Tons, 64,436 ; Total cane milled, metric tons, 486,457 ; Average purity crusher juice, 87·67 ; Fibre in cane, average, 11·06; Tons of cane per ton of sugar, 7·55 ; Total number of cars loaded, 113,018 ; Average weight per car, 4·30 ; Acres cropped, 30,601 ; Average metric tons of cane per acre, 15·90 ; Hectares cropped, 12,389 ; Average metric tons of cane per hectare, 39·26 ; an average extraction in mills, 94·17.—MECHANISM OF CHARCOAL ACTIVATION. **M. E. Barker.** *Ind. & Eng. Chem.*, 1930, **22**, No. 9, 926-931. On activation the true density of charcoal increases, producing an internal shrinkage, resulting in the formation of numerous small spaces within the granule. A crystalline surface is produced. Activation produces a more active surface, and a very large internal surface as well as a large volume of very small capillaries. In the best activated charcoals there is still present a considerable amount of both hydrogen and oxygen.

J. P. O.

[1] See also *I.S.J.*, 1929, 443 ; and in previous years.

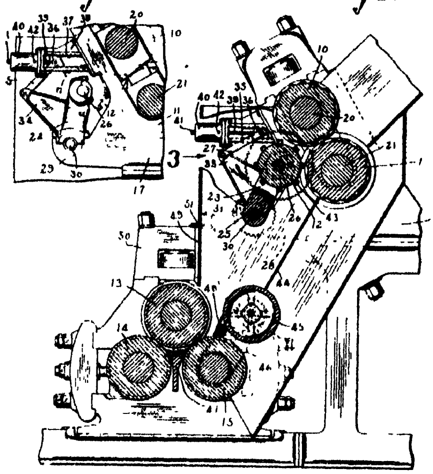
Review of Recent Patents.[1]

UNITED STATES.

CANE CRUSHING APPARATUS (CRUSHER-SHREDDER). **Francis Maxwell,** of Wallington, Surrey. 1,763,855. June 17th, 1930.

Objects of this invention are to provide : a combination of structures, including feeding rolls, a shredding roll, juice expressing rolls, means to assist in the feeding of the shredded cane to the latter ; and means for swinging a shredding roll relatively to another roll, including means to resiliently retain the shredding roll in any desired position relatively to the other roll.

Fig. 2. *Fig. 1.*



The machine or apparatus selected to illustrate the invention is of the type by the use of which cane is received and pressed between a pair of comparatively slowly rotating rolls 10 and 11, and then is acted upon by a shredding roll 12, rotating at a relatively high rate of speed, after which it is fed to a juice-expresssing mill having rolls 13, 14 and 15. The rolls 10 and 11 are journaled in frame members 16 and 17 and co-operate to press cane received therebetween and to crush the same while feeding it toward the roll 12. The rolls 10 and 11, in this instance, are illustrated as being of the Krajewski type, the peripheral surface of each being provided with hollows and ridges which intermesh and cause a partial disintegration of the cane passed therebetween. Intermeshing gears 18 and 19, secured respectively to roll shafts 20 and 21 obtain power through a shaft extension 22, which is suitably driven by any desired source of power. The shredding roll 12 is journaled in arms 23 and 24 of a swingable supporting member 25. A roll shaft 26, to which the roll 12 is secured, extends beyond one of the arms and has a gear 27 secured to the end thereof. The member or support 25 is journaled between brackets 28 and 29, secured respectively to the frames. A roll support carrying shaft 30, upon which the support 25 is rotatably mounted, extends beyond one of the brackets and has a gear 31 secured to the end thereof. A coupling also secured to the outer end of shaft 30 is provided to connect the same with any desired source of power. The gears 27 and 31 intermesh, whereby the power and movement received by the shaft 30 is transmitted to the roll 12. Lever arms 33 and 34 extend outwardly from the arms 23 and 24, and by means of a link 35, are each connected to a slide 36 slidably supported in ways 37, formed in a bracket 38, secured to each frame 16 and 17. Each slide 36 is connected to a piston rod 39, which is reciprocable by means of a fluid operated piston disposed within a cylinder 40. Ports 41 and 42 are provided in the cylinder 40 to permit the entrance therein of suitably controlled operating fluid, whereby the piston 39 and slide 36 may be moved in either direction. The roll 12 is provided with a plurality of shredding teeth 43 which are disposed in longitudinally aligned rows, and in staggered relation with respect to each other about the periphery of the roll. These teeth attack the crushed and broken cane as it emerges from the rolls 10 and 11, and by co-operating with the roll 11, cut up and shred the cane into a substantially wavy mass of fibres whereby the juice cells are thoroughly opened up. The roughened surface of roll 11 tends to retard the cane, due partly to the difference in speed between these rolls while the roll 12 acts upon it.

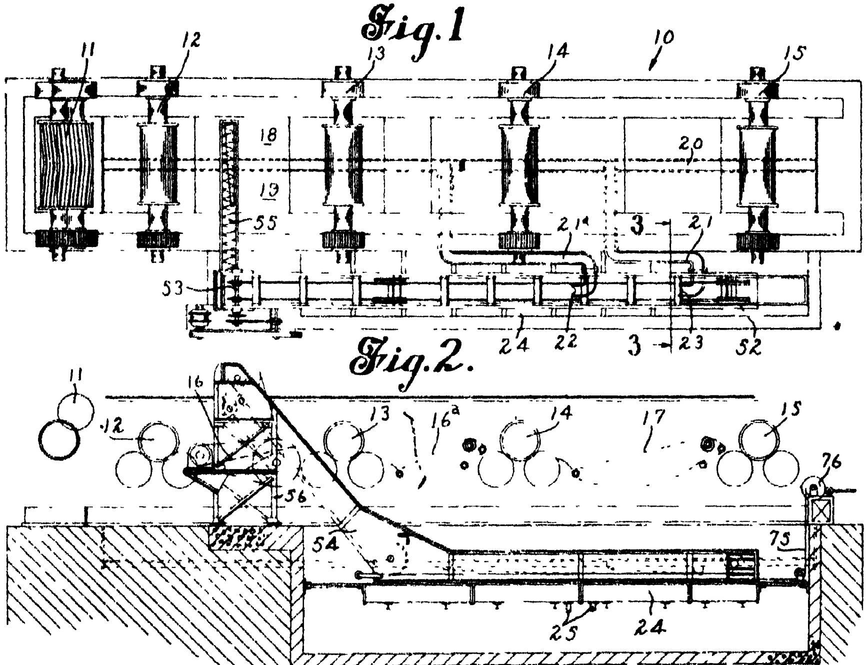
[1] **Copies of specifications of patents with their drawings can be obtained on application to the following—*United Kingdom* : Patent Office, Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2 (price 1s. each). Abstracts of United Kingdom patents marked in our Review with a star (*) are reproduced from the *Illustrated Official Journal (Patents)*, with the permission of the Controller of H.M. Stationery Office, London. Sometimes only the drawing or drawings are so reproduced. *United States* : Commissioner of Patents, Washington, D C. (price 10 cents each). *France* : L'Imprimerie Nationale, 87, rue Vieille, du Temple, Paris. *Germany* · Patentamt, Berlin, Germany.**

The shredded cane, after leaving the shredding roll, is directed toward a juice expressing mill by a chute 44. A roller 45, driven by a belt or chain 46 from roll 15 of this mill, urges the shredded cane into the bite of the co-operating rolls 13 and 15, between which it passes. After passing the rolls 13 and 15, the cane is turned toward the bite of the co-operating rolls 13 and 14, by a turn-plate 47. From rolls 13 and 14 the pressed cane may be directed to subsequent mills when desired. By means of the fluid controlled swingable support 25, the shredder roll 12 may be adjustably positioned with respect to the roll 11, and be resiliently retained thereat. This arrangement permits an adjustment of the constricted passageway between the roll 11 and the roll 12, to vary the same whereby the capacity to receive and shred cane is adjustable to compensate for variations in the quality of the cane being worked. The resiliency afforded by this arrangement prevents choking at this point by permitting the shredding roll 12 to swing away from roll 11, whereby foreign articles or a surplus quantity of cane will be permitted to pass should an occasion arise whereby such should pass the rolls 10 and 11. The provision of means to swing the roll 12 away from the roll 11 also permits an inspection of the apparatus at this point, and facilitates repairs thereto. It is also possible, when it is desired to temporarily or otherwise discontinue the shredding action, for testing the action of the rolls 10 and 11, or other experimental requirements, to prevent the action of the shredding roll 12 by swinging it into inoperative position or a position where the action thereof is substantially ineffective. The degree of the shredding action may be varied as required by variation in cane quality or sugar mill conditions, by this provision, permitting the swinging of the shredding roll. The feed roll 45 assists in the reception of the shredded cane by the rolls 13 and 15, by providing an urge thereupon towards these rolls. A scraper plate 48, associated with the roll 45, relieves it from cane which might adhere thereto and directs it toward the rolls 13 and 15. A cover plate 49 secured to and between the frames 50 which support the rolls 13, 14 and 15, prevents the shredded cane overriding the roll 13, and assists in directing the cane toward the co-operating rolls 13 and 15. The plate 49 may be hingedly supported, as at 51, to permit the inspection or observance of the apparatus and action thereof when desired. The combination of plate 49, roll 45, scraper plate 48, and chute 44, forms means by which the shredded cane is gradually reduced in bulk and partially compressed to facilitate its entrance between rolls 13 and 15, the roll 45 by its rotating movement tending to evenly spread the cane fibre mass longitudinally across these rolls. A modification of this form is finally described.

STRAINER FOR CANE MILLS. (*A*) **Miguel Lopez,** of Santa Clara, Cuba (assignor to **M. Q. Lopez y Perez and E. Perez y Perez,** of Habana, Cuba). 1,763,795. June 17th, 1930. (*B*) **Thomas M. Nalon,** of Ansonia, Conn. (assignor to **E. Perez y Perez and M. Q. Lopez y Perez,** of Habana, Cuba). 1,763,978. June 18th, 1930.

Among objects of this invention are to provide a mill juice strainer or a sectional type whereby any section may be removed and another substituted for it without stopping the mill or the trash conveyor. Figs. 1 and 2 comprise a cane mill with pre-crushing rolls 11, 3-roll mills 12, 13, 14 and 15. Suitable intermediate carriers 16, 16*a* and 17 are provided to convey the mass of cane from one mill to the next. Juice falls upon the inclined platforms 18 and 19, from which it flows into the trough 20. At the same time, a part of the crushed cane or a certain amount of trash may drop from the rolll on to the pans 18 and 19, and be carried into the trough 20 with the juice. This trash and juice then passes downwardly through inclined chutes 21 and 21*a*, the delivery ends 22 and 23 of which are disposed above a juice strainer designated in its entirety by the numeral 24, in Fig. 2. The juice is then strained by being passed through the strainer, where it is collected and carried away by suitable pipes 25 provided for this purpose. The strainer structure comprises a trough channel-shaped in section to catch and retain the juice, the troughs being provided with suitable partitions so that the juice from each of the mills may be separately caught and preserved if desired. The strainer is constructed in sections, each section being substantially identical and being provided with means by which it may be connected to

the adjacent section, so that a substantially unitary device is formed. Each section of the strainer consists of a supporting grid made up of longitudinal web members, T-shaped in form, and transverse web members connected to the longitudinal members and with them forming a rigid frame or support for the strainer itself. The trash conveyor and elevator is arranged to sweep over the strainer and remove the trash and pulp therefrom and deliver it to the mill. Toward the forward end of the mill, the lower flight of the trash elevator passes up an inclined platform 54 so as to carry the trash up this platform and deliver it to the conveyor 55, which carries it to the mill so that it may be again passed through the latter. As shown in Fig. 1, the trash elevator is designed to deliver this trash between the first and second 3-roll mills, although changes may be made in this respect, if desired. A cable 75, as shown in Fig. 2, may be connected to the end section of the strainer and this cable turned



about a winch 76, mounted in a suitable position upon the frame of the mill so that the strainer may be drawn from beneath the trash conveyor. When it is desired for any reason to replace certain or all of the strainer sections, the platform 54 of the trash elevator is raised, as has already been explained, and a new section is connected to the strainer at this end. The winch is then operated to draw the strainer to the right as shown in Fig. 2. As the various sections of the strainer are drawn to the right from beneath the trash conveyor, they are disconnected and the cable attached to the next section and new sections are added to the opposite end until the entire strainer has been renewed, or until that section which is defective has been removed from the machine. This may all be done without stopping either the cane mill or the trash conveyor, so that no interruption to the work of the mill results and as a consequence a substantial economy in operation is effected.

Improvements on Beet Gripping and Conveying Means. **Thos. H. Dolling**, of Huntington Park, Cal. 1,763,422. June 10th, 1930. A chain composed of a plurality of one-piece U-shaped links having their arms all disposed in the same direction and overlapped, pivots passing through said overlapped arms and projecting outwardly therefrom to form spindles, spring-closed beet grippers mounted on the transverse arm-connecting portions of said links, levers fulcrumed to the centres of

said arm-connecting portions and operatively connected with said grippers for opening the latter upon outward swinging of the levers, and rollers on the outer ends of said spindles, and stationary tracks engaging said rollers for holding the chain against outward movement upon outward forcing of said levers.—CANE HARVESTER. **Wm. H. Morgan** (assignor to **The Morgan Hurrycane Co.**, of New York). 1,763,632. June 10th, 1930. Combines a main frame mounted on wheels, a cutter carrying frame located at one side of said main frame, means carried by the main frame and supporting the cutter carrying frame, the said cutter carrying frame being mounted to tilt with reference to the main frame, a cutter carrying shaft mounted in said cutter carrying frame, a plurality of cutters carried by said shaft and means for rotating said shaft.—CANE CAR. **Wm. B. Gregg** (assignor to **The Gregg Co., Ltd.**, of New York). 1,763,698. June 17th, 1930. Combines a stake, a releasing stake pocket having a hinged front closure and means including a screw lock bolt set in a threaded opening surrounded by an outwardly projecting annular rim for locking the same in closed position, and means carried by the stake and effective to prevent the removal of the stake from the stake pocket when the front thereof is closed.—STRAINER. **Miguel Lopez,** of Santa Clara, Cuba. 1,763,795. June 17th, 1930. In a cane mill, a normally stationary strainer, means for delivering juice expressed from the cane to said strainer, said strainer being made up of a plurality of sections directly and detachably connected together and forming an elongated substantially continuous unit, and means for supporting said unit under said delivering means, said supporting means permitting longitudinal movement of the strainer therein, whereby a strainer section at one end may be withdrawn from under the delivering means and detached from the remaining sections.—SUGAR TESTING. **Abraham G. Sheftel.** 1,769,862. July 1st, 1930. Quantitatively determining sugar comprises adding a known quantity of solution to be tested to a known quantity of a standard alkaline solution of copper sulphate, heating the mixture thereby reducing the copper sulphate to yellow cuprous oxide and changing the colour of the solution from blue to green or yellow, the resultant colour depending upon the amount of cuprous oxide formed, this in turn being a factor of the amount of sugar in the solution, and comparing this colour with a standard colour chart the graded colours of which correspond to definite percentages of sugar in the solution.—SPECIFIC GRAVITY INDICATOR. **F. A. Burningham** and **H. K. Moore** (assignors to **Old Colony Trust Co.**, of Boston). Reissue, 17,728; original, 1,697,455. July 15th, 1930. A device of the class described comprising a rockable sector, a hydrometer float, a flexible member engageable with the periphery of said sector and operatively connected to said float, an indicating device, and operative connexions from said sector to said device including an element adjustable toward and from the centre of rocking of said sector.—CLARIFYING MOLASSES. **Robt. Hamburger and Stefan Kaesz** (assignors to **Standard Brands, Inc.**, of Delaware). 1,770,402. July 15th, 1930. Steps are claimed comprising diluting molasses to about 18° Balling, acidulating the solution to a degree of acidity of about 1·2 to 1·4° per 100 c.c. of the mixture, heating the same, adding a double-normal alkali silicate solution, mixing the mass intimately, adding substances which produce a coarser precipitate containing less water, while maintaining the mass in a heated condition, allowing the precipitate to settle, and drawing off the clear solution, the said substances which produce a coarser precipitate being added in amounts larger than those equivalent to the amount of the precipitated silica hydrate.—CANE SLING. **William A. Ramsay,** of Honolulu, T.H. (assignor to **William A. Ramsay, Ltd.** of Honolulu, T.H.). 1,771,314. July 22nd, 1930. A sugar cane sling, includes a cable and two terminal members attached one to each end thereof, each of said members comprising a single casting including a tubular cable-receiving portion having an eye at one end and a pair of co-acting off-set hooks at one side thereof.—UTILIZATION OF VINASSE (MOLASSES DISTILLERY SLOPS). **Joseph Guillissen** (assignor to **Union Chimique Belge, Soc. anon.**, of Brussels, Belgium). 1,772,078. August 5th, 1930. A process for the recovery of nitrogen and acetone from vinasses, comprises subjecting the vinasses to a pyrogenous continuous distillation in a distilling apparatus in the presence of an excess of alkaline earth metal base (over 50 per cent. of the

weight of vinasses) at a pressure substantially equal to the atmospheric pressure and at a temperature below 600°C., thus producing a distillate, subjecting the distillate to a treatment for the recovery of nitrogen and acetone and for the separation of non-oxidizing gases at a comparatively low temperature, sending the non-oxidizing gases at a comparatively low temperature back into the distilling apparatus, as set forth.—WHITE GRANULATED FROM RAW BEET JUICE AND RAW CANE SUGAR. **Rudolph E. Pospisil,** of Chippewa Falls, Wis. (assignor of one-third to **Edmund Kurek**). 1,772,911. August 12th, 1930. A process of making white granulated sugar which consists in treating raw beet juice to recover a massecuite therefrom, mixing raw cane sugar with such massecuite and treating this mixture to recover white sugar.—MANUFACTURE OF ALCOHOL FROM MOLASSES. **Fritz Simmer,** of Lesienice, Poland. 1,744,406. August 26th, 1930. A process of manufacturing spirit and yeast from molasses comprises preliminarily purifying the molasses, adding hydrochloric acid to adjust the hydrogen-ion concentration to an optimum value for pure fermentation, and then adding to the mash a compound of the group consisting of ammonium chloride, ammonium carbonate and ammonium phosphate, whereby waste-waters result which are free from sulphur compounds.

UNITED KINGDOM.

PEAT FERMENTATION. **J. Y. Johnson** (communicated by **I. G. Farbenindustrie A.-G.,** Frankfort-on-Main, Germany). 330,275. February 25th, 1929. Sugar solutions suitable for fermentation purposes are obtained by hydrolysing peat with the aid of acids and treating the product or the solutions separated therefrom, before or after neutralization, with steam or with air while heating, and diluting, if desired, the solutions obtained before fermentation. Thus, raw peat having a 90 per cent. water content is treated with steam under pressure for 45 minutes at 150°C., when steam is led through the reaction product at 90-100°C. for 15 minutes or for 60 minutes. (Reference has been directed by the Comptroller to Specification 21059/91).—THICK-JUICE CLARIFICATION. **Arcos, Ltd.** (**I. Tischtschenko and V. Tchefranoff,** both in Moscow). 330,685; addition to 329,112.[1] April 11th, 1929. Thick-juice obtained in diffusion batteries from dried cossettes which have been subjected to the preliminary treatment described in the parent specification is filtered through sand or charcoal if necessary to remove turbidity and is conveyed without any further purification direct to the vacuum pans.—PURIFICATION OF BEET JUICE. **J. Friedrich,** of Prague. 331,308. April 24th, 1929. Beet juice is purified by heating it under pressure of 1-2½ atmospheres, which correspond to temperatures up to 138°C., for 15 minutes with the addition of about 0·15 per cent. of lime calculated with reference to the beet. The lime is removed by gaseous carbon dioxide or the like.—REFINING RAW SUGAR. **J. B. Talbot-Crosbie,** of Glasgow, and **H. Wiese,** of Nottingham. 331,314. April 30th, 1929. In refining raw sugar, use is made of a sugar solution derived from desiccated beet or other sugar-containing plant as solvent for the raw sugar to be refined. CLARIFICATION. **J. Y. Johnson** (communicated by the **I. G. Farbenindustrie A.-G.,** of Frankfort-on-Main). 332,235. March 11th, 1929. Humus substances are removed from sugar solutions obtained by the complete hydrolysis with acids of peat by treating the solutions with voluminous non-alkaline agents of large superficial area. The purified solutions are used for the cultivation of micro-organisms. Examples of agents which may be used are inorganic oxides or hydrates possessing a gel structure, or charcoal or metal salts which decompose with water only partially and give water soluble salts with humic acids, such as iron chlorides or manganese salts, or aluminium sulphate, lead acetate, active carbon, colloidal silicic acid or alumina. The free acid from the hydrolysis may be neutralized with alkali metal hydroxide, it being preferable to maintain the *pH* value at 5 to 6 or even up to 8. In some cases odorous substances are removed by chlorine, sulphur dioxide, formaldehyde or "chloramin." Examples are given of the use of water-glass along with caustic lime, of wood charcoal and of aluminium sulphate. (Specifications 283,564 and 318,649 are referred to).

[1] *I.S.J.*, 1930, 438.

United Kingdom.

IMPORTS AND EXPORTS OF SUGAR.

IMPORTS.

	One Month ending September 30th.		Nine Months ending September 30th.	
Unrefined Sugars.	1929. Tons.	1930. Tons.	1929. Tons.	1930. Tons.
Poland	147	....	56,307	41,979
Germany	2	420	33,261	45,622
Netherlands	....	....	....	....
France	....	....	....	....
Czecho-Slovakia	....	....	20,067	607
Java	19,420	....	145,879	2
Philippine Islands	....	....	....	....
Cuba	123,919	84,473	629,366	675,918
Dutch Guiana	....	....	....	....
Hayti and San Domingo	18,552	6,900	176,186	211,749
Mexico	....	....	....	....
Peru	9,419	16,025	85,977	66,137
Brazil	....	6,856	11,527	69,127
Union of South Africa	9,880	12,120	42,525	42,722
Mauritius	394	131	168,631	79,580
Australia	12,125	6,485	117,511	76,352
Straits Settlements	....	....	....	....
British West Indies, British Guiana & British Honduras	322	769	88,680	72,043
Other Countries	3,007	3,401	27,425	38,092
Total Raw Sugars	**197,186**	**137,580**	**1,603,343**	**1,419,931**
Refined Sugars.				
Poland	....	....	....	491
Germany	13	10	767	753
Netherlands	471	1,176	12,165	12,057
Belgium	45	116	875	781
France	....	....	....	....
Czecho-Slovakia	751	1,277	20,894	23,510
Java	....	....	....	....
United States of America	684	334	7,947	7,423
Canada	....	....	8	9
Other Countries	12	1	88	26
Total Refined Sugars	**1,977**	**2,915**	**42,743**	**45,049**
Molasses { Foreign	5,229	19,529	133,917	209,415
Molasses { British	1,392	7,433	41,999	24,351
Total Imports	**205,784**	**167,457**	**1,822,002**	**1,698,746**

EXPORTS.

British Refined Sugars.	Tons.	Tons.	Tons.	Tons.
Denmark	57	27	754	435
Netherlands	....	..	....	....
Irish Free State	3,601	3,945	36,925	31,915
Channel Islands	67	115	888	1,314
British West Africa	461	188	2,230	1,480
Canada	....	....	....	....
Other Countries	3,335	40,908	74,293	201,704
	7,521	45,183	115,090	236,848
Foreign & Colonial Sugars.				
Refined and Candy	311	301	1,785	2,677
Unrefined	34	37	583	425
Various Mixed in Bond	....	....	....	....
Molasses	2,436	36	8,325	609
Total Exports	**10,302**	**45,557**	**125,783**	**240,559**

United States.

(*Willett & Gray.*)

(Total of 2,240 lbs.)	1930. Tons.		1929. Tons.
Total Receipts, Jan. 1st to Sept. 27th	1,913,101	..	2,850,747
Deliveries „ „	2,212,755	..	2,501,440
Meltings by Refiners „ „	2,233,071	..	2,357,416
Exports of Refined „ „	33,000	..	74,000
Importers' Stocks, Sept. 27th	137,617	..	447,538
Total Stocks, „	276,895	..	656,286
	1929.		1928.
Total Consumption for twelve months	5,810,980	..	5,542,636

Cuba.

STATEMENT OF EXPORTS AND STOCKS OF SUGAR, AT AUGUST 31ST.

(Tons of 2,240 lbs.)	1928. Tons.		1929. Tons.		1930. Tons.
Exports	2,511,169	..	3,718,038	..	1,858,171
Stocks	828,391	..	739,068	..	1,278,971
	3,339,560	..	4,457,106	..	3,137,142
Local Consumption..	55,806	..	74,379	..	46,296
Receipts at Ports to August 31st ..	3,395,366	..	4,531,485	..	3,183,438

Habana, August 31st, 1930. J. GUMA.—L. MEJER.

United Kingdom.

STATEMENT OF IMPORTS, EXPORTS, AND CONSUMPTION OF FOREIGN SUGAR FOR NINE MONTHS ENDING SEPTEMBER 30TH, 1928, 1929, AND 1930.

IMPORTS.	1928. Tons.	1929. Tons.	1930. Tons.
Refined ..	198,587 ..	42,743 .	45,049
Raw	1,246,817 ..	1,603,343 .	1,419,931
Molasses...	188,998 ..	175,916 ..	233,766
	1,634,402	1,822,002	1,698,746

EXPORTS (Foreign).	1928. Tons.	1929. Tons.	1930. Tons.
Refined ..	4,233 ..	1,785 ..	2,677
Raw	747 ..	583 ..	425
Molasses	3,521 ..	8,325 ..	609
	8,501	10,693	3,711

HOME CONSUMPTION OF IMPORTED SUGAR.

	1928. Tons.		1929. Tons.		1930. Tons.
Refined	200,330	..	43,304	..	43,256
*Refined (in Bond) in the United Kingdom	333,491	..	1,888	..	1,157
†Raw	843,744	..	1,541,594	..	1,556,460
Total of Sugar	1,377,565	..	1,586,786	..	1,600,873
Molasses	5,390	..	7,072	..	5,487
Molasses, manufactured (in Bond) in the United Kingdom..	31,236	..	2	..	6
	1,414,191		1,593,860		1,606,366

STOCKS IN BOND IN THE CUSTOMS WAREHOUSES OR ENTERED TO BE WAREHOUSED AT SEPTEMBER 30TH.

	1928. Tons.		1929. Tons.		1930. Tons.
Manufactured from Home Grown Beet	1,600	..	3,900	..	2,050
Refined in Bond	21,450	..	5,250	..	250
Foreign Refined	12,650	..	8,600	..	6,850
„ Unrefined	115,500	..	229,350	..	164,700
	151,200		247,100		173,850

* The quantities here shown are exclusive of the deliveries of refined sugar which has been produced from duty-paid sugar returned to refineries to be again refined. Sugar refineries ceased working in Bond as from 25th April, 1928.

† The quantities here shown include 163,619 tons entered for refining in refineries in the month ended 30th September, 1930, and 1,468,875 tons in the nine months ended September 30th, 1930.

United Kingdom Monthly Sugar Report.

Our last report was dated 10th September, 1930.

During the first part of this review the general depression continued and prices all over the world fell to new low records, but during the past fortnight a change in sentiment has occurred owing to the belief that some arrangement will be made between Cuba, Java and the Continent in order in some manner to restrict future world production.

The London Terminal Market continued to fall until the end of September, and a report was issued that at this low level of price 52 Centrals in Cuba would not grind next year. From the 1st October the market has rapidly advanced and prices stand to-day 1s. to 1s. 6d. above the bottom. December moved from 4s. 8¼d. to 4s. to 5s., March from 5s. 9¾d. to 5s. 1½d. to 6s. 4½d., May from 6s. to 5s. 3d. to 6s. 7½d., August from 6s. 3¾d. to 5s. 6d. to 6s. 9¾d. There has been little doing in the White Market and prices moved in sympathy with Raws. The latest prices are :—

	DECEMBER		MARCH		MAY		AUGUST
Raw	4s. 9¾d.	..	6s. 2¼d.	..	6s. 5¼d.	..	6s. 8¼d.
White	8s. 0d.	..	8s. 3d.	..	8s. 6d.	..	—

Actual sugar was slow of sale but during the past fortnight there has been a brisk demand. The Refiners' prices continue to fall. On the 15th September they were reduced by 3d., on the 22nd September a further 6d., and on the 29th September 3d. On the 7th October, however, their prices were advanced by 3d. Their latest prices are No. 1 Cubes 23s., London Granulated 19s. 4½d. Home Grown Factories moved their price in sympathy with the Refiners and to-day they range from 18s. 3d. to 18s. 9d. according to Factory.

Business in Raws has been slow and has been almost solely confined to parcels of San Domingoes, Cubans and Perus, the lowest prices recorded being 4s. 9d. c.i.f. To-day's price is nominally quoted at 5s. 9d.

Cuban stocks continue to be large, but the shipments weekly are improving. The present stock continues to be a million tons larger than last year.

With regard to Europe the crop progresses satisfactorily but the sugar content is not so large as was at first expected. LICHT produced an estimate on the 30th September which totalled 7,851,000 tons, excluding Russia, against Dr. MIKUSCH's estimate of 7,584,000 tons. and 7,299,000 tons last year. It is considered, however, that his estimate is 5 per cent. to 10 per cent. too high.

ARTHUR B. HODGE,
Sugar Merchants and Brokers.

21, Mincing Lane,
London, E.C.3.
13th October, 1930.

THE INTERNATIONAL SUGAR JOURNAL.

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No. 383. NOVEMBER, 1930. VOL. XXXII.

Notes and Comments.

The Chadbourne Negotiations.

Since we discussed the outlook a month ago, much more information of a definite nature belonging to or arising out of the Chadbourne committee negotiations has been made public. This committee, as is known, is faced with the task of trying to compose the somewhat conflicting claims of the principal sugar producers of the world in an effort to control the major production of sugar, and so break up the present price impasse. The negotiations were begun in New York, and though no definite pronouncement has been made of the results achieved at that stage, it is assumed that the proposals put forward by Cuba—to reduce her exports to the U.S.A. to an annual quantity of 2,800,000 long tons for five years, and segregate 1,500,000 tons of sugar stocks in Cuba, to be marketed outside the States over the same five-year period, at the rate, roughly, of 300,000 tons per annum, in return for an agreement by her principal rivals for the U.S. market to refrain from increasing their crops beyond the figures of 1930—these proposals have met with sufficient measure of agreement by the other parties to the conference to warrant Mr. CHADBOURNE turning his attention to Europe and the Java sugar interests.

But before travelling to Europe for the next stage of the conference, it has been necessary to get Cuba to confirm her tentative offers; so the CHADBOURNE committee first visited Havana, and arranged with President MACHADO to get the Cuban Congress to ratify the plan. Unfortunately, the first attempt made in the middle of October failed for the reason that a quorum could not be formed, most of the senators and deputies being away in their constituencies preparing for the Cuban elections of November 1st. So the President has been forced to wait till the new Senate is elected and can meet to consider the matter. This was expected to occur by November 10th and at the time of writing it is planned that Mr. CHADBOURNE and his colleagues shall reach Europe by the 18th November. This assumes that the Cuban Congress do not turn down the CHADBOURNE plan sponsored by their President. The latter, as a preliminary step to ensure that the plan works properly, has placed a temporary embargo on the export of Cuban sugars, except where sold prior to October 25th, so as to guarantee that the one and a

half million tons for segregation is kept in the island until the Government can secure authorization to carry out the scheme.

This briefly epitomizes the recent history of the negotiations, so far as they have been made public. The implications are even more interesting. There seems to be a widespread idea even amongst the more cautious that something is going to be done at last to put an end to the vicious circle into which sugar has slipped, and the sugar market has been quick to sense that possibility, and has had several upward bounds recently as rumours seemed to be confirmed. The very Americans who last Spring threw themselves into the balance against the Single Seller in Cuba and brought about its downfall have now gone over to the CHADBOURNE view and are voting to re-establish the Seller—for the latter has never been legally dissolved, and will in one form or another be required to carry out the new restriction proposals. Reports vary as to the extent to which the Cuban producers have so far promised support to the President in making up the 1,500,000 tons quota; but it seems certain that at least 75 per cent., if not considerably more, of that quota has been secured; and the bulk of the producers in Cuba, both Cuban and American, would appear to have promised at least lip-service to the CHADBOURNE plan. Our Havana correspondent suggests, indeed, that these bodies have had no opportunity for collective voting on the question. In view, however, of the fact that they are not properly organized, the Cuban Government can hardly be blamed for deciding to shepherd them into what it deems is the right fold rather than allow them to be swayed by weighty but irrelevant considerations. So, providing the Senate votes according to plan, we may expect that Cuba will agree to do her part in the CHADBOURNE scheme.[1]

Java and Europe.

There remain Java and Europe. In many quarters continued scepticism has prevailed as to any hope of getting Java to join; the abortive instance of 1929 is quoted. But conditions have undoubtedly changed for the worse since the earlier negotiations were begun by TARAFA; the slump in sugar prices has deepened, the favourite markets of Java have suffered from national unrest, and not all the Java sugar industrialists are content with the modest profit they are now getting from their industry and must continue to get if sugar prices remain at their present uneconomic level. In fact, reports from Java suggest that for the 1932 crop plantings are being reduced, in part or *in toto*, by some of the more severely affected factories, and a rice crop substituted. On the other hand, the main objection of Java—that the earlier negotiations left out the American continental and territorial competition—is now presumably being remedied, since it is American bankers and not merely Cuban politicians who are calling the tune. There may also be something in the argument advanced that if low prices do not allow Java to crush out her Cuban and other rivals speedily, there is nothing to be gained by keeping prices low, and apparently the CHADBOURNE plan if carried out as far as the American part of the scheme is concerned would be sufficient to keep prices above the lowest. But probably it is truer that Java's main consideration is to ensure that her trump cards are not transferred to other hands. Subject to this, we believe she is more willing to negotiate than has been supposed in some market quarters.

As a matter of fact, we have good reason for thinking that when negotiations are opened at Amsterdam it will be found that the Dutch-Java interests

[1] For details of the proposals as applying to Cuba, and of the arrangements mooted for carrying out the segregation plan, see the Article on "Renewed Sales Control in Cuba" on another page.

are ready with a scheme to cover their own share in the agreement, a scheme that may prove a reasonable and impartial one. Whether, as has been suggested, it will include the proviso of a segregation also of sugar from their surplus stocks or an offer to reduce future crops, we ought to know before very long.

There remain the principal sugar exporters of the European zone. These cannot be left out of the scheme, and sufficient good will undoubtedly exists to make it probable that they will on their part enter into the new negotiations, when asked to do so. LICHT expresses the hope that by that time the various European countries concerned will have arrived at an understanding between themselves as to what propositions they will submit as their contribution to the international agreement. Unfortunately Germany, for one, is in a difficult position, as she has not decided on the restrictions to be put on next year's campaign ; and, furthermore, she is faced with a much larger exportable surplus this campaign, amounting to between five and six hundred thousand tons. But she will gain nothing by electing to stand aloof, unless she is sure of a market for her increased export quota. So abstention on her part seems an improbable contingency. As for Czecho-Slovakia, the loss of her large British market of late years and the slender chance of her getting it back by any change in the British sugar duties would suggest the incentive for a modification in her output.

The American Influence in Cuba.

It may indeed turn out to be the case that of all the different interests whose points of view have to be reconciled, Mr. CHADBOURNE may find the hardest task lies in roping in the diverse American zones concerned in producing sugar. For even in Cuba the American sugar interests have vacillated in their policy during the last few years and on at least two occasions have defeated a reasonably conceived scheme for improving Cuba's economic position. Thus in 1928 it was the American-owned mills in Cuba that forced the abandonment of the restriction scheme just when signs of success were evident. As a consequence the Cuban production got out of hand and within 12 months had to be put under control once more under far less favourable circumstances. In the second or more recent instance, it was the Americans who broke up the Single Seller's operations last Spring, a proceeding that has had the very opposite effect on the price of sugar that was confidently forecasted. Now after only six months' interval most of these very Americans are agreeing to support Mr. CHADBOURNE in taking a step that virtually restores the Single Seller to action. It may well be asked why the American bankers who are so ready now to finance a scheme running into millions of dollars on behalf of Cuba's sugar were so shortsighted six months ago as to refuse the very financial aid that would have achieved the same object ? True, the new scheme is more complete in its ramifications, but it might just as well have been proposed twelve months ago if sufficient foresight had been shown by the financial leaders.

The history of these vacillations is told in some detail in a pamphlet just issued by an economist of some note, which we review on another page. Mr. J. W. F. ROWE succinctly sums up the history of the last ten years of Cuba's struggles to establish her sugar industry on a sound basis, and shows how this has been in part a contest for survival between the large American-owned and the smaller Cuban-owned mills. The former have been too exclusively concerned in trying to crush out the latter, without regard to

considerations of Cuban economy as a whole. The result is that this economy has arrived at a stage which is distinctly embarrassing to the United States. If the Cubans are driven through bankruptcy to revolutionary despair, intervention may be forced on the States and it may be difficult to avoid the sequel of annexation. But, as Mr. ROWE reminds us, annexation is the last thing the other American sugar interests, both continental and territorial, wish for, since a Cuba within the Union would mean that Cuban sugar like that of Porto Rico must enter the United States free and thereby compete on equal terms with other American produced sugar, including that of Hawaii and Louisiana. A prosperous Cuba could easily undersell them all, so that the United States would merely have cleared up one mess to establish several others. It is becoming apparent that their better policy is to put Cuba on her independent legs once more and preserve her fiscal relations undisturbed. And it may be assumed that Mr. CHADBOURNE, with the American banking interests behind him, is working to that end.

The Imperial Conference.

One of the periodical conferences which take place every few years between the Government of the United Kingdom and the British Dominion Governments has been held this Autumn in London, and has been remarkable for the definite offer by the Dominion representatives of a basis of trade reciprocity between the Home country and the different territories of the Empire. The Prime Minister of Canada was probably the chief exponent of the policy, but all other countries save British India expressed themselves in the same terms. Briefly, they rejected the idea of an Imperial "*Zollverein*," as it was deemed impracticable to remove all Customs barriers even for other Empire products, but they one and all asked for a preferential market in the United Kingdom for Empire-produced food, especially for wheat, and offered in return a preferential market for United Kingdom manufactures.

Unfortunately the Government of the day here is a Labour one who (even if we concede them the best will in the world to endeavour to arrive at a mutually satisfactory arrangement) are still ruled too predominantly by free trade doctrinaires, of whom Mr. SNOWDEN is the chief. The Prime Minister (Mr. MACDONALD) has consequently declared that his Government are unable to meet the wishes of the Dominions in so far as these would necessitate our taxing imports of foreign food. Mr. BALDWIN (who has just lately been confirmed in the position of leader of the Conservative party by a vote of four to one) has hastened to accept the Conference basis of reciprocity. Unfortunately there have been continued dissensions within the party, egged on by the propaganda of certain " press lords " who are agitating for the taxation of foreign food imports as an axiomatic article of the new fiscal faith. Mr. BALDWIN, on the other hand, has declared rather for the policy of a free hand to impose such taxes as seem to be necessitated by firm reciprocatory offers on the part of the Dominions; food taxes are not precluded, but neither are they promised irrespective of what they will obtain for Home trade as a quid pro quo. Details with the Empire have still to be thrashed out.

As the matter stands, the Labour Government decision holds sway for the time being. It possesses a small majority in Parliament, just so long as the three score Liberals refrain from joining with the Conservatives in voting against the Labour party. So far the Liberals have kept them in office; it remains to be seen how long these Liberals will be content to be, as

has not inaptly been put, hewers of wood and drawers of water for Labour, in return for a nebulous promise of electoral reform. The minimum life of the Labour Government is put at a few months ; its maximum a matter of a year or two. Meantime, the overseas members of the Conference are returning home with their major proposals rejected for the time being ; and at home the problem of unemployment becomes increasingly acute because the Government will not take the fiscal steps that nearly all the federations of industry and chambers of commerce in the country have decided by majority votes to be necessary for the rehabilitation of the country's fortunes.

We have reverted once more to this subject of political economics in the United Kingdom, because with it is closely bound up the question of the sugar supply of the country. In the event of a Conservative Government getting into power within the next few months, it is probable that sugar, which is already under fiscal supervision, will be one of the first to receive fresh attention in the light of the Dominion offers of reciprocity. On another page we reproduce a Memorandum prepared by the Sugar Federation of the British Empire for submission to the Delegates to the Imperial Conference, which shows succinctly the beneficient effects that have already resulted within recent years from the operations of the Imperial Preference duty on sugar in force in this country. These effects are sufficiently conclusive as to warrant the hope that the preferences will be extended by any Government advocating tariff reciprocity; and the ultimate outcome will be, as likely as not, that a much larger proportion of the sugar consumed in the United Kingdom will be derived from Empire sources than the 33⅓ per cent. at present drawn. Political changes within the United Kingdom may therefore influence considerably within the next decade the geographical distribution of her sugar production.

It may be urged that the present time, when international action is being invoked to restrict expansion of production beyond current consumption needs, is the last one wherein to encourage any expansion of sugar production within the British Empire. But apart from the point that this latter expansion will not necessarily be a precipitate one, it is merely the enforcing of a new basic idea that Empire consumption of sugar shall be preferentially supplied from Empire sources. The continued existence of those large producers of sugar for outside markets—in particular Cuba and Java—will increasingly depend on their ability to find fresh outlets, presumably amongst the vast populations of Asia. With no large home population or preserved market for their sugar, they run risks by continuing to depend so much on one staple crop ; and the increasing orientation of the United Kingdom towards Empire sugar is a symptom that cannot be ignored. It is not an immediate factor, but in the long run will probably play a decisive rôle.

British Colonial Sugar Crop Reports.

From Barclay's Bank (D. C. & O.) Monthly Review we compile the following information on current conditions in the British sugar colonies :—

Mauritius.—Trading conditions have continued dull during the past quarter. The cutting of the cane crop began in August and is estimated at 225,000 tons. At the start the Sugar Syndicate had sold 148,000 tons, for delivery in September onwards, of which 127,000 tons of raws were sold at an average price of Rs. 6·76. By mid-October 85 per cent. of the crop had been sold for forward delivery. The local Government is assisting the sugar industry by a loan to manufacturers, free of interest, from the Improvements and Devel ment Fund, of £1 per ton of sugar produced from this season's

Barbados.—Heavy rains were experienced towards the end of July, but thereafter there was an increasing absence of rain till the beginning of October which retarded the growth of the young 1931 canes. Latterly, good showers have fallen but more rain would be welcome. The crop lately finished is estimated at around 85,000 tons. For next season a fair acreage is being placed under cotton. On September 30th it was resolved by the Barbados House of Assembly that the sugar industry of the island be assisted during the present crisis "by a system of stabilizing the selling price of sugar, molasses and syrup, and that the Governor-in-Executive Committee be requested to send down a bill to effect the purpose for the crops of 1930-31." *Trinidad.*—Till August weather conditions were very favourable in the island for the growing crops, but latterly the weather has been too dry and the growth of the canes in most districts has been somewhat retarded. The froghopper pest is stated to be fairly plentiful on most sugar estates, but no serious damage has so far been reported. *Jamaica.*—Rainfall was more or less general during August, deficient in September, but good rains were again experienced by the beginning of October, and the sugar crop for 1931 appears to be well up to the average. The total output of sugar and rum in Jamaica for the 1929-30 season was 64,697 tons and 14,937 puncheons respectively. The increase in sugar production this year is entirely due to the excellent weather conditions experienced during the growing period, and the yield per acre on nearly all the estates has been higher than in previous seasons. *Leeward Islands.*—The output of sugar in Antigua during 1930 was 18,257 tons, as compared with 10,730 tons in 1929; and of St. Kitts, 18,701 tons, as compared with 13,724 tons. The hurricane of September 1st swept over Dominica destroying about 75 per cent. of the crops, but missed Antigua and St. Kitts, so the sugar industry was not affected as it was in 1929. *British Guiana.*— The past quarter began with excessive rain and then a hot and dry season set in. The position in regard to the sugar industry remains very acute. As a temporary measure, in order to afford relief the export tax on sugar of 1½ per cent. has been remitted as from September 16th. On all the sugar estates the end of the year grinding is general, and the yield is reported to be good.

Molasses in Germany.—Next campaign, Dr. H. Claassen points out,[1] one may in Germany expect a beet crop of 12 million tons of roots, the molasses from which will be 450,000 tons (3·15 per cent.); the outlet for some of this may be as follows; desaccharification, 85,000 (18·9 per cent.); alcohol and yeast manufacture, 145,000 (32·2 per cent.); mixing with beet pulp for fodder, 30,000 (6·7 per cent.); various purposes, 20,000 (4·4 per cent.), giving a total of 280,000 tons (62·2 per cent.), leaving a balance of 170,000 tons. Export will be possible only at the most reduced prices; and the difficult problem will be to utilize the remainder, i.e., more than one-third of the total production, as cattle food, or find some other means of utilization.

"Salometer" Applications.—In both cane and beet sugar manufacture, the "Salometer" apparatus for the determination of the electrical conductivity can render good service when applied to the various massecuites for the calculation of the possible yield from them, which can be done more rapidly and more accurately than by the usual formulae employing the polarization and Brix values. It is also being reported as very helpful in the examination of boiler waters, raw juices, clarified juices, evaporator syrup, sugars, and not least molasses, using in the latter product the ash ratio, or saline coefficient (sucrose per cent. divided by ash per cent.) Often also, the accuracy of sampling of a product can be rapidly controlled by the conductivity value.

[1] *Deut. Zuckerind.*, 1930, **55**, No. 20, 586.

Renewed Sales Control in Cuba.

By EARL L. SYMES.

After nearly six months of uncontrolled sales during which about a million and a half tons of Cuban raw sugar were sold, a new organization is being formed to take charge of another 1,500,000 tons which is to be withdrawn from the market, thus reducing the carry-over. This is the outcome of the various meetings held in New York during the past two months between the Northern bankers and other American interests controlling 70 per cent. of the sugar industry in Cuba and the members of the Cuban committee designated to carry on this work In our August article the work of this group was mentioned and at that time it was generally supposed that some constructive plan would be evolved to increase consumption. Much to the surprise of sugar producers in Cuba nothing of the sort has resulted. Upon the publication of the sales control plan and the restriction in exports to the United States, three prominent members of the Santa Clara Mill Owners' Association have resigned from that organization's directorate due to their espousal of the very ideas to which that body has been diametrically opposed. They were members of the committee which visited New York and have apparently changed their opinions which were so effective in overthrowing the C.E.A. last April. It was reported that up to October 15th more than 75 per cent. of the production had been signed up as favouring the new plan.

Certain measures are included in the present plan which will undoubtedly help to make it stick, the principal being that the Republic of Cuba is to purchase 1,500,000 tons of raw sugar at the price of $4.00 per bag, issuing about $40,000,000 of bonds to pay for the sugar. The interest is to be at the rate of 5½ per cent. and a new tax of 11 cents per bag of sugar made in each of the next ten crops is to be collected to pay the service and other expenses including losses that may occur in selling. The sales committee is to be composed of four Cubans and four Americans who will select a ninth member to preside. It is proposed to sell this sugar at the rate of about 300,000 tons a year over a period of five years, after which time amortization of the bonds will begin. A petition signed by three quarters of the producers has been sent to the President of the Republic requesting him to secure the legislation needed for this governmental financing of the sugar purchase and also to issue the decrees that he may deem pertinent to the future operation of this plan.

Considering this abrupt change of front among the so-called leaders of the sugar industry there is naturally arising a vigorous opposition. The local refiners and also the representatives of the U.S. refiner-raw producers have alligned themselves with several native Cuban producers. However, there is little hope of success with such a large majority endorsing the scheme. It is stated by these men that this new plan is simply the old TARAFA plan which called for organized sales and crop restriction, somewhat disguised and equipped with teeth. By isolating this large amount of sugar, prices have risen and this allows other holders to market their sugars while Cuba holds the bag. One division of the Cuban committee has just presented a lengthy memorandum to the President asking for tax reduction and another section of the committee suggests that a new tax be added. Present national, provincial and municipal taxes amount to about 30 cents per bag and the total would be 41 cents with the new plan. Furthermore, no general meeting of the mill owners has been called to discuss the plan. Invitations have bee issued to all producers to call on Sr. VIRIATO GUTIERREZ and discuss the me with him. In this way no united opposition can make itself heard or l

strong enough to embarrass the passage of the required legislation through Congress.

Weather conditions in Cuba have been almost ideal for the growing cane except certain sections in the Eastern end of the Island. The normal rainfall for the nine months to the end of September is 41·52 in. and the average over the Island has been 40·49. Some dry weather was experienced in July and August, but normal spring and fall plantings have been made in spite of stringent financial conditions. There is little doubt but that there is enough cane to produce at least four and a half million tons of sugar. However, with the threatened limitation of exports in 1931 to the United States to a maximum of 2,800,000 and the expected carry-over of at least 300,000 tons besides the large amount now sold to the Cuban Government, it is very probable that the coming crop will be restricted to four million tons or less.

It is quite possible that the new organization if properly directed will succeed in restoring the sugar industry of Cuba to a more prosperous level since it seems to be adequately financed and to have enough authority to regulate both production and marketing of the crops. Both crop restriction and sales expansion require serious study. In the first case there are many mills in Cuba that have been bankrupt for the past five years, but have been supported by the banks throwing good money after bad. It is estimated that the annual production of all of these artificially sustained mills is about 800,000 tons. By eliminating these producing units until such time as they can be profitably operated, it would be unnecessary to restrict the crops at other mills which are financially sound, and at most losing money from their previously earned surpluses. Some of the unfit companies that have been allowed to survive have had deficits varying from one to three hundred thousand dollars each year since 1924; in some cases the interest charges alone amount to a million dollars annually on a plantation which is valued at three million dollars when put up for auction.

The committee which is to supervise the marketing of the segregated sugar is presided over by Mr. THOMAS CHADBOURNE who was the guiding spirit in getting this new plan made up. The four American members are Messrs. DOUGLAS, HAYDEN, GIBSON and BARTLETT; and Senores PEDROSO, LOPEZ ONA, CERVERA and GOMEZ MENA have been designated to represent the Cuban producers. Messrs. CHADBOURNE and VIRIATO GUTIERREZ are about to leave for Europe to confer with continental producers and the representatives from Java. Control of a block of 1,500,000 tons of sugar that may be shipped to any competitive market by the Cuban delegates will probably be considered a trump card in the negotiations. However, agreements reached under such circumstances may not be considered so binding by the smaller producers.

A delegation of three Cubans has gone to China accompanied by several Chinese business men from Havana. The object of this trip is to obtain a concession for the duty-free import of a large amount of Cuban sugar to be refined, it is understood, at Shanghai by The China National Sugar Refining Co. This project has no direct connexion with the new government plan at this time.

Since the market has now reacted from its depression it may be that the September price in public warehouse will set the low record for some time to come. The following are the net prices in cents per pound :—

	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Ave.
[illegible]	1·78	1·68	1·67	1·61	1·54	1·49	1·82	1·80	1·93	1·97	1·70	1·71	1·78
[illegible]	[illegible]64	1·53	1·58	1·42	1·19	1·15	1·05	0·99	0·93				

Renewed Sales Control in Cuba.

In spite of these ruinous prices, reports from 129 mills to the Department of Agriculture indicate a total 1930 planting of 304,000 acres, which is considered about the normal amount to replace old fields. Ten mills did not make any plantings and no reports were received from eighteen. Estimates as to the number of mills which will not grind the next crop vary from ten to seventy, but the resumption of governmental control will probably induce some to try it for one year more.

British Empire Sugar Policy.

A Memorandum by the Sugar Federation.

The Council of the Sugar Federation of the British Empire (of which Mr. L. S. Amery, M.P., is Chairman) representing the associations of producers and refiners of sugar throughout the British Empire has prepared a short but incisive Memorandum on Empire Sugar Policy, for the consideration of the delegates to the Imperial Conference which has met in London this Autumn. It contains the following facts and considerations relating to the sugar industry of the British Empire.

"That industry has enjoyed the advantages of a constructive policy in which the chief producing and consuming countries of the Empire have in considerable measure co-operated. Apart from the direct protection afforded to the Australian and South African producers of sugar in their own home market, and from the very substantial assistance more recently given to the production of beet sugar in the United Kingdom, the preferences which have been in force in the United Kingdom and in Canada have played the leading part in this development.

"The United Kingdom preference for Empire sugar, initiated in 1919, was, after various alterations, stabilized in 1925, and stands to-day at about 3s. 9d. per cwt. on 96° raw sugar. Of the value of this preference in stimulating and maintaining the Empire sugar industry there can be no doubt. Its effect has been, perhaps, most marked in the case of the two sugar producing Dominions, Australia and South Africa, where the preference has made possible a large expansion of an industry which would otherwise have had to be confined to the limited requirements of the home market. In 1919 Australia produced a total of 160,000 tons of sugar. In 1928 she exported 200,000 tons, practically all to the United Kingdom, out of a total production of 522,000 tons. In 1924-5, South Africa produced 163,000 tons, of which she exported 9000 tons, the whole of which went to the United Kingdom. This year her export to the United Kingdom is already known to be about 125,000 tons out of a production of 340,000 tons. In the sugar producing Colonies the effect has been, if not to lead to any great increase of total production, at any rate to enable the production of cane sugar to be maintained through a period of great difficulty and falling prices.

"Britain's consumption of sugar in 1913 was 1,731,930 tons (all imported), her total imports during that year being 1,969,260 tons, of which only 75,311 tons came from the Empire. The consumption in 1929, exclusive of home-grown sugar, was 1,778,625 tons raw value, while imports amounted to 2,111,226 tons, of which 710,165 tons or 33·63 per cent. was Empire sugar from overseas. To this must be added 234,742 tons (probably 450,000 t[illegible] in 1930-31) of British beet sugar, encouraged since 1924 by a sub[illegible] subsidy of 19s. 6d. per cwt. for the first four years, 13s. per cwt. fo[illegible] three years and 6s. 6d. for the following three years, in addition [illegible]

preference. This made the total assistance to British beet sugar production during the first four years of subsidy 26s. 10½d. if the subsidy on molasses is included.

"In the Budget of 1928 a further step was taken and a differentiation of ¼d. per lb. made in the duties between refined and raw sugar, resulting in a great stimulation of the British sugar refining industry and of the employment directly and indirectly afforded by it, and in a reduction of ¼d. per lb. in the price of sugar sold by retail to the consumer, the whole of the reduction being passed on to the consumer.

"The effectiveness of the Canadian preference, first introduced as long ago as 1907, and standing since 1926 at approximately 4s. 8d. per cwt. for 96° raw sugars, is indicated by recent import figures. In 1924 Empire sugar imports into Canada amounted to 175,000 tons out of a total import of 388,806 tons, or 45 per cent. In 1928 they amounted to 312,000 tons out of a total import of 426,000 tons, or 73·24 per cent. The benefit has chiefly accrued to the sugar producing colonies and in particular to the British West Indies, British Guiana and Fiji. The latter colony affords a striking instance of the efficacy of the preference. In 1924 Canada imported 5321 tons of sugar from Fiji. In 1928 Canada's imports of Fiji sugar amounted to 76,063 tons. It is also noteworthy that South Africa sold over 40,000 tons to Canada during 1930. This compares with 16,000 tons to Canada in 1929, nil in 1928, and 5000 tons in 1927.

"The sugar production of the Empire rose from a total of 700,000 tons in 1912-13 to 1,508,000 tons in 1928-29. Even at a normally low figure of £10 per ton, that would represent a value of £15,080,000. These figures do not include the very large production (about 2,700,000 to 2,800,000 tons) of sugar, largely of a very crude type, produced and consumed annually within the Indian Empire.

"This development in the sugar producing countries of the Empire, helped by the reciprocal preferences which they accord to the sugar using countries, has led to a considerable general development of trade with the rest of the Empire, and, in particular, to large purchases of machinery for the equipment of sugar factories and estates. In the case of South Africa the value of such material obtained from the United Kingdom since Empire preference on sugar was introduced there, has greatly exceeded £1,000,000; and in the years from 1920 to 1928 Empire sugar-producing countries have taken nearly £6,000,000 worth of sugar machinery from the mother country. In the Colonies this equipment has assisted in the continuous effort to improve the factories and their organization, and has enabled them to meet in a large measure the competition of such favoured producers as Java and Cuba. The importance of the sugar industry to the exchange position, and consequently to the purchasing power, of Australia and South Africa, is another factor worth taking into consideration.

"There is no ground for suggesting that these undoubted mutual advantages have been secured at the expense of the consumer in the preference-giving countries of the Empire. Sugar, even before the war the cheapest in relation to its food value of all foodstuffs, is to-day less than 40 per cent. dearer than in July, 1914, whereas most other staple foods are dearer by between 50 and 80 per cent. At the present moment sugar is cheaper in England than in any other country, with the possible exception of Belgium. It may consequently be stated with confidence that the constructive [illegible] in operation in the Empire in recent years has, so far as it has it [illegible] undoubted success. That policy is, however, to-day imperilled,

not only by the universal depression, but more particularly by the action of other countries which, influenced by the importance of the sugar industry in their general economic scheme, have embarked on sugar policies even more advanced, and certainly more aggresive than ours, as well as, temporarily, by the remarkable start Java sugar production has been able to secure by thr combined effect of advanced research and cheap labour. The extent ' which the progressive railing off of most foreign countries has left the so-cal' "world " market a mere residual market for the dumping of surplus su has reacted with especial severity upon producers in the British sugar-gro Colonies, which, unlike the sugar-growing Dominions, have no home m for which they produce in the first instance, and which rely upon pref only for the further expansion of their production by the cheaper dis their surplus. These sugar-producing Colonies, although producin at the lowest cost in the British Empire, are passing through a v crisis, and are now in such a serious condition that it is uncertain hov can survive. Their case has been eloquently and forcibly set fort OLIVIER, and by the late Sir FRANCIS WATTS, in their reports on t in the British West Indies and in Mauritius.

"The Council of this Federation ventures to submit to Dele Imperial Conference that it would be in the highest degree unfo artificial and temporary fall in price should be allowed to put communities out of action, depriving them of their livelihood their standard of living, as well as their revenue upon which the w of efficiency of their administration depends, to destroy mar invested capital, and to deprive the rest of the Empire of a growing trade, with the final result that when British competi killed off, prices may be raised once more. The Council believes of allowing a successful policy to be frustrated by outside act worth while considering whether the time has not come for increase in preference as will enable Empire production to go on st the inevitable consequence which increased production brings with falling steadily and gradually, without sacrifice of the the producer by improvements in methods and organization. It is not undue producers, but continuity and stability of the Empire market for E in the interests of all concerned, that is the aim of this Federatio

"Alternative methods of achieving this object have been publ cated. In regard to bulk purchase, the practical difficulties, both and political, have been freely discussed, and the only additional obs the Council would make upon this aspect of the matter is that bulk purchase whether otherwise desirable or not, could only operate as an instrument of preference if the purchasing authority worked under definite instructions as to the preference to be given to Empire sugar in their contracts. A quota system would, it is true, have a more automatic preferential effect, both in securing a steady volume of sales and in promoting competition among importers to secure their quota. It might also provide a satisfactory solution to the problem of sugar beet cultivation in the United Kingdom, which is now responsible for keeping under the plough 320,000 acres of land. But the careful consideration of these alternatives still leaves the Federation of t' opinion that, as far as its experience goes, the extension of the existing sy of fiscal preference would afford the simplest and most effective m dealing with the situation."

onomics of Recent Cuban Sugar History.

The Effects of Artificial Control.

The London and Cambridge Economic Service, a series of publications prepared by the Schools of Economy at London and Cambridge Universities in o-operation with the Harvard University Committee on Economic Research, s lately issued the first of a series of studies in the Artificial Control of v Material Supplies, this being devoted to *Sugar*.[1] It is from the pen of J. W. F. ROWE and consists of 60 quarto pages, 43 of which are devoted onsideration of the sugar industry of Cuba, and the rest to the economics marketing of Java sugar. In what follows we give the gist of Mr. s conspectus of recent Cuban sugar history and the chief conclusions draws from his studies.[2] Mr. ROWE has clearly made a very detailed taking investigation into this economic subject, and those interested attempts during the last ten years first to expand and then to er sugar industry will find this pamphlet the most comprehensive npact account of the operations that has yet been published

WE commences with a brief survey of the Cuban sugar industry riod at the close of the last century when the Cubans freed them- Spanish sovereignty. At that time the industry had reached an t over one million tons, and was essentially an industry of the financed and managed by them. The Civil War drove Spain ure but brought in the United States, whose economic occupa- nd steadily increased till at the present day it controls at least he sugar industry. Mr. ROWE sketches the rise in the output ugar crop, the effect of the Great War on production in Cuba, price vicissitudes of the last ten years.

enter on a consideration of the main causes of the depression has marked the last few years. In general the chief cause of all as been excessive production; little fault can be found with if we admit that the pre-war rate of consumption has suffered either was there any appreciable excess production till 1924-25. the Cuban crop rose by a million tons to the 5-million ton level, on undertaken in the belief that the European beet crop would ny years to regain its pre-war level. Europe, however, made an rapid recovery in the same year, largely, of course, as a result of ion and/or bounties. "Cuba made a terrible mistake in expand- ction in 1922, though it is difficult to say that she ought to have etter. For even a 5-million ton capacity in Cuba and a European t c fully restored to pre-war level (i.e., a further addition of 1 million tons to the 1924-25 crop) would have been required within two or three years, and the Cuban restriction policy was based on this assumption. Again, however, Cuba was wrong, because by 1928-29 there was a further increase of 2½ million tons in the world's production." Of this Java contributed one million, while Formosa, Hawaii and the Philippines had considerable increases.

Mr. ROWE demonstrates that restriction by Cuba had little to do with the increase in the Java crop, for that was almost wholly due to the introduction of a new high-yielding variety of cane. The same is true of Formosa and apan where a high protective tariff was the incentive, while the U.S. tariff responsible for the increase from Hawaii and the Philippines. Tariff ion also accounts for much of the increase from the rest of the world,

[1] Memorandum No. 31: Studies in the Artificial Control of Raw Material Supplies. By No. 1. Sugar. (London School of Economics, Houghton Street, London, W.C. 2.)

[2] he Java sugar industry we hope to notice in a subsequent issue.—Ed.

and restriction in Cuba can hardly be made directly responsible for an increase elsewhere of more than 200,000 to 300,000 tons. "Cuba has in fact been very largely the innocent victim of the consumer, who has deliberately preferred to obtain his supplies in a more expensive way than was economically necessary." But Cuba has been handicapped by an economic problem of her own, in that her older and smaller Cuban-owned mills, turning out about one-third of the sugar crop, produce at a higher cost than do the larger and American-owned mills. The Cuban Government gave its support to the policy of restriction largely in order to prevent the extinction of these high-cost producers and the consequent complete domination of American capital. Thus apart from the struggle between Cuba and the rest of the world, "there has been going on an equally desperate struggle between the high-cost and low-cost producers within Cuba or, in other words, between the Cuban-owned mills, with the Cuban Government as an ally, and American capital." Properly located, organized and equipped, the sugar industry of Cuba, concludes Mr. Rowe, would be able to produce 5-10 million tons far more cheaply than any country in the world with the possible exception of Java. But the world does not want sugar on an economic basis.

Had the Cuban Government acquiesced in any policy of *laissez-faire*, the old high-cost small mills and plantations in exhausted land in western Cuba would have been abandoned and new large scale mills and plantations would have been established on the rich fertile lands of eastern Cuba, where the American influence was predominant. The result would have been a severe contraction of Government revenues and widespread unemployment, plus the complete domination of American capital, a prospect that no Cuban Government dared face without a struggle. So *laissez faire* even if economically the best policy was in practice virtually out of the question.

Hence Mr. Rowe concludes that given the practical necessity for some attempt at artificial control, restriction was the right form to adopt at the outset in 1926, since supplies were too large to be remedied by any scheme of stockholding. But in 1927 there was a halt in world consumption and Cuba chose to intensify control, and probably correctly, for otherwise the sacrifices of the two previous years would have been in vain. So she restricted her crop to 4 million tons and formed an Export Corporation to market the sugar destined for countries other than the U.S.A. This Export Corporation scheme was better than no control, but ideally the whole crop should have been marketed by one authority. But at that date a Single Seller scheme was impracticable on financial grounds and would have lacked American support. As it was, the control of 1927-28 broke down owing to the U.S. market purchasing less Cuban sugar than was anticipated; this sent prices lower while at the same time the restriction to 4 million tons increased costs of production. At this point, in Mr. Rowe's view, there was room for a stock-holding scheme; if even 250,000 tons could have been firmly held, it would have made all the difference, for the price might have been maintained near the 3 cent level. But the Cuban Government lost heart at this juncture, and the American interests were able to bring all attempts at control to an end.

But it is arguable that this abandonment of control occurred just when signs of success were appearing on the horizon. For consumption after its halt in 1926-27 had resumed its rapid increase, and if Cuba had continued to restrict her crop to 4 million tons, the total world production in 1928-29 would have amounted to just 26 million tons, while consumption was eventually to reach nearly 900,000 tons more than this amount. Stocks would therefore

have been reduced well below 2 million tons and with a continued increase of consumption the position might have gradually righted itself, for the expansion of tariff-protected and bounty-fed supplies had already approached its limits. In short, Cuba had at least a reasonably sporting chance. Instead, Cuba in 1928-29 produced over 5 million tons, and within a period of 12 months was forced to resume a policy of control under circumstances far less favourable than would have existed if control of some sort had been maintained continuously.

The final attempt at control was the Co-operative Export Agency of 1929. Although supposed to be more favourable to American ideas than a policy of restriction of output, the scheme was virtually forced on to the Americans by the Cuban Government and the Cuban-owned mills, and the latter hoped to use it in self-preservation, while the Cuban Government approved of it for that very reason. It was undoubtedly intended to force up prices to a reasonable level by putting any excess supply into storage. But, as recent history knows, the scheme required for its success adequate financial backing and the American banks were not in a mood for a gamble after the Wall Street crash, nor, in the case of those interested in Cuban properties, were they anxious to hold out any helping hand to the Cuban-owned mills, so the final effort at control fell through.

As for the position of the moment, and future prospects, Mr. ROWE only confirms current expert opinion that the present crisis is fundamentally one of stock-holding and not a crisis due to excessive productive capacity. If the rumoured pool actually comes into being and buys up, say, 1 million tons, and thus can satisfy the urgent cash needs of the Cuban mills, the market might feel it had got sufficient assurance against a further fall in price, and refiners and middlemen would then take care of the remaining supplies. Without some such assurance demand must continue sluggish and the price may suffer a further fall. It may seem incredible that the price can go any lower, but since it now really depends simply on ability to hold stocks, and has little relation to conditions of current production and consumption, there is almost no limit to the potential fall.

Till the turn comes, Cuba's position is thus most critical. Economically she ought long ago to have been brought within the tariff wall of the U.S.A., but to do so now would spell ruin for the domestic and insular sugar industries of the States that have been built up during the last twenty years, and must be protected at all costs. Hence the United States would be vastly embarrassed by any development of an annexation policy for Cuba. Nor would Cuban nationalism tolerate the prospect, however desperate the economic position. Hence Cuba must find means to hold out till the tide turns and her sugar production can be more fully absorbed by the world's growing consumption. "Cuba's trouble in the long run is not that the world is ceasing to require her sugar; her real trouble is whether the business of producing this sugar is to pass entirely into the hands of the American capitalist, leaving to the Cuban people merely the rôle of the dogs under the rich man's table."

We could quote many other excerpts from this interesting pamphlet, but lack of space and other considerations preclude us from doing so. Those interested in this chapter of Cuban history should possess themselves of a copy of the Memorandum.

VAN MOLL'S TABLES.—These well-known Brix Tables, we are informed by the publishers in Java, are now being published on a basis of 27·5°C., instead of 20°C. as formerly.

South African Sugar Notes.

(By our Durban Correspondent.)

In common with the rest of the sugar world South Africa is still feeling the pinch of low prices. The increase of duty from £8. per ton to £12. 10s. has not proved entirely effective in keeping out foreign sugars. When the duty was increased the existing dumping duties were removed. The reason for this move is not clear, though it may not be unconnected with a reluctance on the part of the Government to go to the Imperial Conference with a dumping duty in force against Canada. Whatever the reason it has resulted in a quantity of foreign sugar, chiefly American, being landed in the country at prices below the local standard. As there seemed no hope of any further protection, the industry has been compelled to face the only alternative in lowering the price on the local market. In June, therefore, the local price of 1st Refined was reduced from £24. 10s. to £23. a ton. The various levies imposed by the Crop Disposal Committee to meet the rebates to manufacturers and freight to coast ports as well as such other activities as advertising and propaganda, reduce this to below £20. and with the heavy export loss the price of cane of 13 per cent. sucrose is in the neighbourhood of 13s. 3d., which is certainly not a payable proposition. This low price of cane must inevitably reflect seriously on the agricultural efficiency of the industry, as planters are unable to afford to fertilize properly and fields are carried on to extra ratoons when they should be ploughed out and re-planted. Thus planters are carrying on by drawing on their capital, a state of affairs which cannot continue indefinitely.

The Suspended Duty.—A curious impasse has occurred in the operation of the new sugar duties. The original duty was £8. per ton of which £3. 10s. was a suspended duty provisional on the industry fulfilling certain conditions and had been separately gazetted when these conditions were fulfilled. The new duty of £12. 10s. also included this suspended portion which was presumed to remain effective. It appeared later that with the alteration of the duty the suspended duty should have been re-gazetted separately, but this was not done. The duty had been made retrospective from last March and the suspended duty was wrongly collected on sugar imported after that date, a number of merchants paying under protest. The mistake was not realized until July when a special proclamation was prepared and rushed by special messenger for signature by the Governor General, who at the time was in Zululand on a farewell visit. The mistake necessitated the refund of about £12,000. to various importers.

Arbitration Board.—The Draft Bill which was outlined in our last report has not been proceeded with, but at the beginning of September members of the Board of Trade under the chairmanship of Mr. F. J. Fahey, the "step-father of the sugar industry," visited Durban to investigate the desirability of establishing a permanent Board of Arbitration and to hear any other evidence that the industry cared to bring forward. The hearing was conducted in Durban and occupied several days. The planters presented a considerable docket of written evidence on a number of points and stressed strongly the desirability of establishing such a Board, in view of the number of outstanding questions arising out of the interpretation of the Fahey Conference Agreement, and the continual minor differences of opinion which tended to create ill-feeling between the different sections of the industry. The millers on the other hand opposed the formation of the Board as likely to create a condition of uncertainty and instability, especially as the finding

of the Board in the case of a single dispute would become a rule binding on the whole of the industry. Evidence was presented on a number of the points, but the Chairman stated definitely that the Board were not prepared to consider any revision of the Fahey Conference Agreement before its normal expiry in 1937. The Board's findings will be published later, presumably before the next Parliamentary Session in February.

The Crop.—The 1930 crop is proving to be an exceptionally heavy one, and the sucrose content is unusually high. The drought has broken before any considerable loss of cane had taken place. It is estimated that at least 375,000 tons of sugar will be produced and 380,000 tons is possible. If the local consumption remains at 200,000 tons, which in view of the general depression is not certain, then the export will amount to at least 47 per cent. of the total crop. Thus the export is rising annually as the following table shows :—

Year	Total Production	Total Exported	Per Cent. Exported
1927-28	247,273	61,519	19
1928-29	295,834	85,531	29
1929-30	298,635	127,245	42
1930-31 (estimated)	375,000	175,000	47

Thus every year a larger proportion of our crop is exported at an ever reduced price. If it were not for the Imperial Preference the position would be very dark indeed. The effect on the average price is indicated by the following rough calculation :—

200,000 tons of 1st Refined at £20.* per ton	£4,000,000
175,000 tons of Raws exported at £7. 10s. per ton	1,312,500
= £14. 3s. 4d. per ton.	£5,312,500

* Nett after allowing for excise and all levies.

This is equivalent to a drop in the price of cane from 16s. 8½d. per ton to 13s. 3d. per ton of cane of 13 per cent. sucrose. The significance of this drop becomes apparent when it is realized that the cost of producing a ton of cane is taken officially at 15s. 6d. per ton, although in actual practice it is somewhat lower.

From the quality standpoint the season is also proving to be a good one. Sucrose and purity are both running high, a fact which will prove the salvation of many a planter who would not otherwise be able to weather the hard times.

The Length of the Season.—The heavy crop is further accentuating the vexed question of the length of the season. At present it seems inevitable that most factories will be obliged to continue crushing until late in January, although the sucrose content of the cane has always proved to be very low after the middle of December. As most of the factories are now working at their fullest capacity and a number of small units have been closed down and dismantled, the problem looks likely to become more and more acute with each succeeding season. The desirability of limiting the crop or at any rate controlling the expansion of new areas is being mooted, but the problem is one which bristles with difficulties and the experiences of other countries in this connexion are not too hopeful. This was one of the matters referred to the Board of Trade during the recent enquiry, and their report on the subject should prove interesting.

Beet Industry Foreshadowed.—A report has recently appeared in the press that a company has been formed in England for the purpose of growing beets and manufacturing sugar in South Africa.[1] Several well known names in

[1] See *I.S.J.*, 1930, 412.